SUSTAINABLE FOREST MANAGEMENT NETWORK

RÉSEAU DE GESTION DURABLE DES FORÊTS

Proceedings of the Sustainable Forest Management Network Workshop

MARKET BASED APPROACHES FOR SUSTAINING ECOSYSTEM SERVICES FROM ALBERTA'S FORESTS

DECEMBER 2-4, 2009

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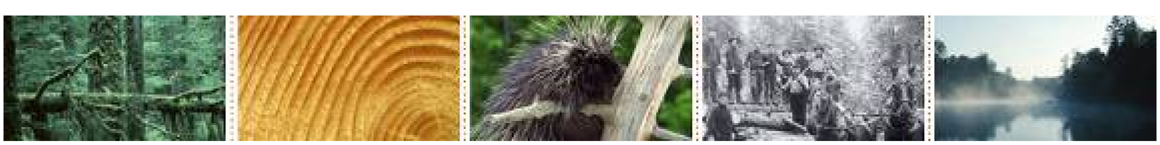

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- **John Stadt**, *Alberta Sustainable Resource Development*
- **Barry White**, *Alberta Sustainable Resource Development*
- **Jenny Woo**, *Department of Rural Economy, University of Alberta*

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8:45 am	**WORKSHOP FORMAT AND OBJECTIVES** **Marian Weber,** *Alberta Research Council, University of Alberta*
9:00 am	**OVERVIEW OF SFMN RESEARCH ON INCENTIVES AND ECONOMICS OF BIODIVERSITY CONSERVATION** **Marian Weber**, *Alberta Research Council, University of Alberta* **Vic Adamowicz**, *University of Alberta*
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1:00 pm	**KEYNOTE: FACTORS INFLUENCING MARKETS FOR ECOSYSTEM SERVICES** **Amy Ando,** *University of Illinois, Urbana*
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3:30 pm	**PANEL 3. DESIGNING ROBUST MARKETS FOR ECOSYSTEM SERVICES** Moderator: **Marian Weber,** *Alberta Research Council, University of Alberta* • **Amy Ando,** *University of Illinois, Urbana*

- **Veronika Nemes**, *Senior Economist, Department of Sustainability and the Environment, Government of Victoria, Melbourne*
- **Stuart Whitten,** *Institutional Analyst/Economist, Commonwealth Scientific and Industrial Research Organization, Canberra*

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Friday, December 4
Prairie Room, University of Alberta (Lister) Conference Centre, Edmonton AB

8:30 am | **COFFEE**

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Moderator: **Elizabeth Wilman**, *University of Calgary*

- **Avelyn Nicol**, *Land-use Secretariat, Government of Alberta*
- **Steve Price**, *Alberta Forestry Research Institute*
- **Jim Schieck**, *Alberta Biodiversity Monitoring Institute*

10:15 am | **COFFEE BREAK**

10:45 am | **PANEL 5. PARTICIPANT RESPONSE**

Moderator: **Vic Adamowicz,** *University of Alberta*

- **Panelists TBA**

12:15 pm | **FINAL COMMENTS AND ADJOURN**

Marian Weber, *Alberta Research Council, University of Alberta*

12:30 pm | **LUNCH**

Speaker Biographies

OPENING SPEAKER

HONOURABLE TED MORTON
Legislative Assembly of Alberta, Edmonton

Ted Morton is the Minister of Sustainable Resource Development. He was elected to his second term as a Member of the Legislative Assembly of Alberta for the constituency of Foothills-Rocky View in March 2008. He was first elected in November 2004 and became Minister of Sustainable Resource Development in December 2006.

Morton obtained his B.A. in political science from Colorado College, and his M.A. and Ph.D. in political economy from the University of Toronto. From 1981 to 2004 Morton was a professor with the University of Calgary and a visiting professor at institutions in Quebec, France, the United States and Australia. In 1998 he was elected as a Senator-in-waiting in Alberta's second-ever Senate election. In 2001 he served as director of policy and research, office of the Leader of the Official Opposition, Parliament of Canada. He has received several career awards and distinctions, including Phi Beta Kappa (1971); Best Nonfiction Book of 1992, Alberta Writers Guild; Bora Laskin National Fellowship in Human Rights (1995); and the runner-up, Donner book prize for best book on Canadian public policy (2000). In 2001 he was recognized in Macleans' Guide to Canadian Universities as one of the 20 most popular professors at the University of Calgary. Morton has published numerous scholarly articles and six books.

KEYNOTE SPEAKER

AMY ANDO
University of Illinois, Urbana

Amy Ando is an Associate Professor in the Department of Agricultural and Consumer Economics at the University of Illinois, USA. Ando works primarily on problems of species and land conservation, including the optimal reserve-site selection problem and understanding the relationship between private and public conservation activity. She has also studied other topics related to environmental policy and political economy, such as the enforcement of natural resource damage liability statutes, the determinants of household recycling behavior and rain-barrel adoption, and the welfare effects of ethanol policy.

Ando has a B.A. in economics from the Williams College and a Ph.D. in Economics from the Massachusetts Institute of Technology. She serves on the editorial boards of the *American Journal of Agricultural Economics* and the *Letters in Spatial and Resource Sciences*, and has served on several major review panels for multidisciplinary grant competitions. In service to the national conservation community, Ando serves on the program committee for the Wildlife Habitat Policy Research Program and sits on the Environment Programs' Habitat Advisory Committee for the Doris Duke Charitable Foundation. In Illinois, Ando works to help inform Stormwater management policies in the City of Chicago, and served on the Sustainability Advisory Commission for the City of Urbana in its inaugural year.

SPEAKERS AND MODERATORS

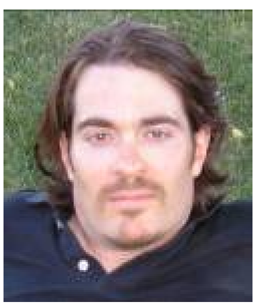
(IN ALPHABETICAL ORDER)

VIC ADAMOWICZ

University of Alberta, Edmonton

Vic Adamowicz is a Distinguished University Professor in the Department of Rural Economy, Faculty of Agricultural, Life & Environmental Sciences, University of Alberta. His research interests are in developing methods that integrate environmental goods and services into economic analysis and designing policies and institutions that help capture the importance of environmental services in economic decision-making. His main research areas include environmental valuation, economic assessment of environmental changes, and consumer choice modeling. His research interests also include the incorporation of economic perspectives into sustainable forest management and the development and implementation of economic instruments for environmental protection.

Adamowicz obtained his B.Sc. and M.Sc. from the University of Alberta and his Ph.D. from the University of Minnesota. From 1998 to 2004 he was the Scientific Director of the Sustainable Forest Management Network, one of Canada's Networks of Centres of Excellence. He was awarded the J Gordin Kaplan Award for Excellence in Research in 2005 and the Canadian Institute of Forestry's Canadian Forestry Scientific Achievement Award in 2004. He was elected to be a Fellow of the Royal Society of Canada, Academy II – Social Sciences, in 2007. In 2001-2002 Adamowicz was a Gilbert White Visiting Fellow at Resources for the Future in Washington DC and in 1998/99 he was a Killam Annual Professor at the University of Alberta.



JAY ANDERSON

University of Alberta, Edmonton

Jay Anderson is a postdoctoral fellow in the Department of Rural Economy at the University of Alberta. His areas of interest are environmental policy, natural resource economics, and benefit/cost analysis. He has authored or co-authored numerous academic publications, editorials, reports, and proceedings. He has also worked as a consultant for a number of government agencies and private firms.

Anderson is an economist and registered professional forester. He graduated from the University of Alberta with a B.Sc. in forestry and a Ph.D. in forest economics. During his graduate studies, Anderson was awarded a doctoral fellowship from the Social Sciences and Humanities Research Council of Canada, as well as the T.W. Manning Book Prize for the highest grades in his program.

ROBERT DEAL

US Forest Service, Portland

Robert Deal is a research forester and ecosystem services science team leader for the US Forest Service, Pacific Northwest Research Station in Portland, Oregon. He has 30 years of professional forester and research experience working throughout the Pacific Northwest (PNW) and Alaska. His research interests are in applied silviculture – including research on stand development, regeneration, ecosystem services, and silvicultural practices to enhance compatible forest management.

Deal led a team of scientists from the PNW Research Station to synthesize information on ecosystem services in the Deschutes National Forest in central Oregon. He has also represented the US Forest Service at working group meetings to develop the Willamette Partnership's Counting on the Environment Project. This culminated in the development of an accounting system agreed upon by all federal and state regulating agencies that quantifies the benefits of restoration projects for application to ecosystem service markets. Deal is author and editor of more than 60 forestry research publications including the recent book Sustainable Forestry Management and Wood Production in a Global Economy. He currently serves as Deputy Coordinator for the International Union of Forest Research Organizations (IUFRO) Research Group *Sustainable Utilization of Forest Products*.

CRAIG DENISOFF

Westervelt Ecological Services, Sacramento

Craig Denisoff is the Vice President and founding partner of Westervelt Ecological Services – a national environmental mitigation company and subsidiary of The Westervelt Company. Denisoff also served as President of the National Mitigation Banking Association from 2004 to 2007. He was also Senior Vice President at Wildlands Inc. for seven years. Denisoff has worked for the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, California State Legislature, and was Assistant Secretary for the California Resources Agency, where he supervised the State's nationally recognized wetland and coastal programs. He has consulted on and developed several key guidance documents for national mitigation policies, as well as mitigation policies for the State of California.

Denisoff has a B.A. in economics from the University of California, a master's of public administration with an emphasis in resources planning from San Francisco State University, and has performed postgraduate studies in aquatic ecology at the University of California. He has also published several articles on fisheries management, coastal issues, regional wetlands planning, and mitigation and conservation banking. He is a recognized national and international expert in the field of habitat and species mitigation banking. In addition to being an expert source in several national press articles, he has consulted with international governments on the establishment of habitat trading programs.

RUSSELL KRAUSS

Resource Environmental Solutions, Houston

Russell Krauss is the Vice President of Business Development at Resource Environmental Solutions LLC. He is responsible for providing executive leadership and management of inbound and outbound business development and marketing activities including corporate development, transactional business development, corporate and alliance marketing, and funding, offerings and resource management. He has over 24 years experience developing new markets in technical, support, sales, marketing and management roles for technology products and services in the global upstream oil and gas industry with Marathon Oil, Digital Equipment Corporation, Cray Research, and Sun Microsystems. He acquired executive management experience as VP of Marketing with oil industry services and technology providers Knowledge Reservoir, LLC and Object Reservoir Inc.

Krauss holds a bachelor's degree in geology from Boston University and an MBA from the Executive MBA Program at the University of Houston. Krauss also served as COO of SCAN USA, a technology services firm for the US law enforcement community and CEO of Greater Sooner Holding, a publicly traded holding company. His expertise includes distribution channel development, leveraged business models and routes to market, organizational design, corporate strategy and operations, marketing, contracting, mergers and acquisitions.

VERONIKA NEMES
Victoria Department of Sustainability and the Environment, Melbourne

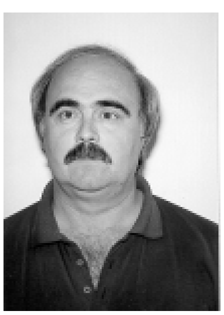
Veronika Nemes is Senior Economist and Manager of the Economic Design Team at the Victoria Department of Sustainability and Environment. She is currently researching and managing projects in the area of climate change and natural resource management. Her specialization includes the environmental, political and economic debate surrounding climate change and biodiversity conservation.

Nemes holds a B.A. in economics, an MBA, and a Ph.D. in experimental economics from the University of Melbourne. Nemes has taught at the University of Melbourne, Boston University's School for Field Studies, and the Galapagos Institute of Arts and Sciences. She has also worked on a range of policy issues, such as designing markets for ecosystem services, designing auctions for storm-water runoff mitigation, and designing policies to address wastewater, climate change and energy efficiency. Prior to her Ph.D. studies, Nemes worked on the development of the electronic trading platform of the German and Swiss Options and Futures markets, and for the Chicago Board of Trade as a business analyst and consultant.

AVELYN NICOL
Alberta Land-use Secretariat, Edmonton

Avelyn Nicol is a Senior Policy Manager in the Land-use Secretariat. She has spent the last ten years working for various departments in the Government of Alberta, mostly in environmental policy capacities.

Nicol has a B.Sc. in environmental and conservation sciences from the University of Alberta. She began her career in Alberta Parks as a nature guide in the boreal forest. After completing her B.Sc. in 1998, she worked on the Special Places program to create new protected areas in the province. Later in 2005, she moved to Alberta Environment, where she worked as a Senior Policy Advisor working on the Land-use Framework and other cross-ministry policy initiatives. Following the Land Trust Leadership consultations she helped facilitate the establishment and support for the Alberta Land Trust Alliance.



STEVE PRICE
Alberta Forestry Research Institute, Edmonton

Steve Price is the Executive Director of the Alberta Forestry Research Institute. He is also working on a part time basis with the Institute for Agriculture, Forestry and the Environment to assist with forestry considerations.

Price is a graduate of the University of Toronto. He commenced his career in Saskatchewan with the Department of Natural Resources, Forestry Branch. He held numerous positions with the Saskatchewan Government, including Manager of Forest Inventory and Manager of Silviculture. In 1983 he joined Forestry Canada as Senior Development Officer at the Northern Forestry Centre in Edmonton, eventually becoming Program Director of Regional Development in 1989. He also served as the Director of Operations for the Canadian Forest Service in Ottawa. Upon returning to Edmonton in 1992, he managed forestry research, which at that time included climate change, fire systems, applied silviculture, social science and landscape management research units. He also managed operational programs, including the Model Forest Program and the First Nations Forestry Program in Manitoba, Saskatchewan, Alberta and the NWT. Price also managed several international projects in southern Africa and SE Asia. In 2007 Price retired from the federal government and joined the Alberta Forestry Research Institute.

JIM SCHIECK

Alberta Research Council, Edmonton

Jim Schieck has been a Research Scientist at the Alberta Research Council for the past 16 years. In addition, he is an adjunct professor at the University of Alberta, and the Science Director for the Alberta Biodiversity Monitoring Institute. His expertise includes avian ecology, population dynamics, community ecology, forest ecology, and conservation biology.

Schieck has B.Sc. and M.Sc. degrees from the University of Western Ontario, and a Ph.D. from the University of Alberta. He has published more than 20 papers in scientific journals, helped to organize more than 10 workshops, and produced more than 100 client reports. He has extensive experience developing and leading large ecological research projects. These projects often involve collaboration with researchers having expertise in plant ecology, wildlife ecology, statistics, and conservation biology.

RICHARD SCHNEIDER

University of Alberta, Edmonton

Richard Schneider is a research associate in the Natural Sciences and Engineering Research Council of Canada Integrated Landscape Management Lab at the University of Alberta**.** There he is leading various modeling studies that simulate land use trends in Alberta under alternative management scenarios.

Schneider has a degree in veterinary medicine from the University of Saskatchewan and a Ph.D. in wildlife epidemiology from the University of Guelph. He has extensive computer modeling experience in the areas of wildlife management and forest management. Since coming to Alberta 15 years ago he has been actively involved in the development of forest management policy in the province, and has written several influential papers and a book on this topic. Over the past two years he has been active in the development of the Alberta Land-use Framework.

MARIAN WEBER

Alberta Research Council, Edmonton

Marian Weber leads Alberta Research Council's Environmental Policy Program, where she works with government, industry, and NGOs on developing market based approaches for managing environmental services from land and water resources. She is also an Adjunct Professor in the Department of Rural Economy at the University of Alberta.

Weber has a Ph.D. in economics from the University of Alberta. Recent areas of research include developing markets for biodiversity conservation on public and private lands, payments for water quality improvement, and water trading.

STUART WHITTEN

Commonwealth Scientific and Industrial Research Organization, Canberra

Stuart Whitten is an institutional analyst/economist at Commonwealth Scientific and Industrial Research Organization (CSIRO) Sustainable Ecosystems. His expertise includes environmental and resource economics, with specialization in market-based instruments, incentive design and implementation, institutional design and analysis, environmental valuation, project management, and research and reporting for complex multi-disciplinary and multiple stakeholder research projects. He has broad-based experience in environmental valuation and policy design.

Whitten has a B.A. degree in agricultural economics from the University of New England, a M.Phil. in economics from Cambridge University, and a Ph.D. in environmental economics from The University of New South Wales. He joined CSIRO in 2002 as leader of a project on markets for ecosystem services. He has since led the development of a small team specializing in the design, implementation and support of natural resource management. Prior to joining CSIRO, Whitten was the primary researcher for a project on the private and social values of wetlands at the University of New South Wales. He also has experience with ACTEW Corporation, where he was responsible for preparing pricing submissions and demand modeling of water supply and sewage treatment.

ELIZABETH WILMAN

University of Calgary, Calgary

Elizabeth Wilman is a professor in the Department of Economics at the University of Calgary. Her research focuses on environmental and natural resource economics, particularly on the implementation of economic instruments for environmental protection, biodiversity and resource management. Her current research projects include carbon sequestration in soils, an economic model of aboriginal fire-stick farming, international environmental agreements, regulation of greenhouse gases, and carbon offsets.

Wilman has a Ph.D. in natural resource economics from the University of Michigan. Before joining the University of Calgary in 1985, she was a Fellow at Resources for the Future in Washington, D.C. in the Quality of the Environment Division. During 1998/1999 she was a Visiting Fellow in the Department of Forestry at Australian National University, and she recently served as the Associate Dean (Student Affairs and Programs) for the Faculty of Social Sciences. She also served as Head of the Department of Economics between 2001 and 2006.

Workshop Summary

Introduction

Interest in the use of market based approaches for conservation of the Boreal Forest has increased over the past decade. The boreal forest presents a number of unique challenges for policy including from an ecological perspective the dynamic and shifting structural and habitat features of the forest, as well as from an economic perspective the complexity of managing overlapping tenures and resources,. A number of research projects supported by the Sustainable Forest Management Network have evaluated the use of market based policies to managing caribou, biodiversity, carbon, and other Ecosystem Services (ES) provided by public forest land.[1] These include:

- Natural Capital and ecosystem valuation as a tool for sustainable forest Management (http://www.sfmnetwork.ca/html/project_77_e.htm)
- Ecological and economic trade-off analysis of conservation strategies for Woodland Caribou (http://www.sfmnetwork.ca/html/project_83_e.html); and
- Incentive Policies for Sustainable Forest Management (http://www.sfmnetwork.ca/html/project_17_e.html).

The Government of Alberta is considering market based approaches for boreal conservation, including conservation offsets and tradable disturbance permits. In addition, a temporary government agency, the Institute for Agriculture, Forestry and the Environment (IAFE) was established to develop a policy framework to harness market forces for improving environmental performance. These initiatives have stimulated discussion between government, stakeholders, and practitioners on how market based approaches for conserving boreal ecosystems might be implemented, and, in particular, what lessons can be learned from other jurisdictions that have used similar approaches. Based on the emerging needs of government, industry, NGO and First Nations to understand how market based approaches could work to achieve environmental objectives in the boreal forest, the Sustainable Forest Management Network hosted the workshop "Market Based Approaches for Sustaining Ecosystems in Alberta's Forests" in December 2009. The goals of the workshop were to:

- Illustrate and synthesize the various innovative policy options for participants;
- Learn about government priorities with respect to forest management
- Review lessons on implementation from other jurisdictions
- Articulate the opportunities and barriers to the various approaches, and identify priorities for moving these policies forward.

The workshop format was a set of panels, each addressing key design and implementation issues associated with conservation markets. This report

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[1] Ecosystem services are "benefits that people obtain from nature". These are typically divided into four categories: provisioning services such provision of food, water, timber, and fiber; regulating services such as climate and flood control and waste assimilation; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, pollination, and nutrient cycling (otherwise known as ecosystem functions)

summarizes the key lessons learned in the workshop. The workshop is introduced with an initial session summarizing SFMN research related to conservation markets. Invited speakers were given a set of questions for each panel prior to the workshop. During the panel, the speakers each provided a 10 minute response to the questions. This was followed by a moderated discussion between the panel and the audience. On the second day, workshop participants engaged in Alberta land management issues were asked to summarize how the information provided on the first day could be used to shape conservation policies in Alberta.

Session1. Overview of SFMN Research on Incentives & Economics of Biodiversity Conservation

Background Alberta's Boreal Forest Context

- The majority of Alberta's forested land base is public land
- The boreal forest lies above the Western Canadian Sedimentary Basin, which is one of the world's largest hydrocarbon resources. Disturbace required to explore and develop subsurface resources is significant and much of the footprint has not been reclaimed.
- The majority of forest timber is allocated in two types of tenure: forest management units (FMUs) which are volume based timber harvest rights; and Forest Management Agreements (FMAs) or area based timber harvest rights. Oil and gas leases are issued in bi-weekly auctions. Developers require rights for surface access from FMA holders or the government.
- Although timber is managed according to sustained yield policy, there is the potential to exceed the sustainability thresholds for other Ecosystem Services (ES) particularly when the combined and cumulative impacts of timber harvest, fire, and surface disturbance from oil and gas are considered.
- The need for new approaches has been recognized by government Market based approaches have been used to successfully manage cumulative effects in air and water.
- Tradable disturbance permits and conservation offsets could be used to manage cumulative effects on public lands

Market Based Instruments (MBIs)

- MBIs are policies that use price and other economic incentives to encourage environmental stewardship and meet environmental objectives or constraints.
- Market based approaches are "decentralized" and flexible – through exchange individuals interacting in a market reveal the costs associated with environmental constraints. In theory, rights to use the environment are reallocated in the market to the highest benefit use, thus minimizing the overall cost of achieving environmental objectives.
- There are two types of MBIs – quantity based and price based. Price based approaches to managing disturbance include development charges and taxes. Quantity based approaches include Tradable Disturbance Permits and Offsets.
- Tradable Disturbance Permits and offsets allow firms to substitute their ecological footprint in one location and/or point in time with a reduced footprint in another location/point of time as long as global disturbance objectives are satisfied. In this workshop we focus on quantity based programs.

Tradable Disturbance Permit (TDP) Programs

- In TDP programs the government sets a target for the total amount of footprint allowed on the landscape, and translates this into an annual cap on the level of disturbance permitted on the landscape (e.g. total number of hectares per year). Rights to disturb up to the cap are allocated to firms either through grandfathering or auction. Firms may trade permits amongst each other.

- Permits/disturbances are treated as equivalent no matter where the disturbance occurs and irrespective of the quality of habitat disturbed.

Offsets/Mitigation Banking

- Offset or mitigation banking programs require firms to create equivalent environmental offsets for their activities based on pre-defined criteria. Offsets may be created and sold through mitigation, reclamation, or avoidance activities. Offset programs are usually associated with no net loss requirements for specific species or ecosystems (e.g. wetlands) and often use specific functionality criteria to define the ecological equivalence of the offset. However, offsets may also be based on simple coarse filter metrics such as habitat loss.
- Unlike TDP programs, the duration of the offset requirement (and hence the permit) is usually permanent or semi permanent. This introduces a number of risk factors and potential liabilities for buyers and sellers of permits that are absent from TDP programs.

Design and evaluation of TDPs

- *Determining objectives for TDPs*
    - TDPs are rights to disturb habitat in a given period. This is a coarse filter approach to biodiversity management. This raises two questions: first, how do coarse filter management objectives relate to valued outcomes related to biodiversity or other ecosystem services; and secondly, on what criteria should coarse filter objectives be defined (e.g. by habitat type, stand age, etc.)?

- *Trading Rules*
    - Development features on landscape (roads, pipelines, etc.) have different impacts on ES, so how do we make them commensurable from a trading perspective?
    - Complex measures of ecological equivalence can create significant heterogeneity in the goods being traded, and can reduce the effectiveness of the program through reducing liquidity in the market, and increasing the potential for hold-out problems in negotiating trades;
    - Simpler measures include coarse filter/habitat based measures that can be combined with trading ratios and exchange rates to account for differences in impact or significant areas.
    - TDPs are annual rights, but projects may go on for several years. To address the multi-period permit requirements and ecological risks, firms could be required to purchase all required TDPs up front and hold permits for the duration of an impact (similar to an offset). Unused permits could be re-sold at the end of the project.

- *Initial allocation of permits*
    - There are two basic options for the initial allocation of permits: grandfathering based on historic land use or rights; or through government auction. Given that there are large forestry and energy investments, grandfathering at least some of the permits makes sense from a political feasibility perspective.

  - Grandfathering permits allows for the potential redistribution of resource rents to permit holders; any grandfathering rule should be designed with caution and should consider interactions between the permit market, the oil and gas lease auctions, and impacts on resource rent collection for the Province of Alberta.

- *Setting the cap*
  - The cap is set by determining the environmental objective and then translating the objective (desired ecological outcome) into an annual cap on the amount of disturbance or footprint allowed on the landscape.
  - The cap can be adjusted for the impacts of natural disturbances such as fire and pests. The government can choose to have a rigid or adaptive approach to managing the annual allocation of permits. In the first case, the rigid institution, the amount of permits allocated in each period is fixed and is not adjusted to account for things like fire which occur during a period. In the adaptive institution, the cap is adjusted up or down depending on whether there was more or less natural disturbance from other causes than expected. This rule is similar to the share systems used to define Individual Transferable Quotas in the fisheries and water allocations in Australia.

Evaluation of TDP Programs

- *Methods*
  - Two methods were used to test the performance of various design options for TDPs: experimental analysis and agent-based modeling.
  - Experimental analysis is useful for understanding how agents interact under alternative market rules, and how close to 'optimal' they will behave.
  - Agent based models are important for capturing the complex dynamic interactions between agents and the ecosystem. The agent based approach in this case is important because the energy sector's exploration behavior in any given period is determined by past discoveries. Therefore the outcomes of behaviors of agents in the past (e.g. generated by mistakes or uncertainty) persist in the future in ways which are random.

- *Results*
  - Common results from the agent based and experimental evaluation of options include:
  - The grandfathering of TDPs only to forest companies (with energy companies forced to purchase from forest companies) is inefficient and seems to create an entry barrier to energy companies
  - Because the energy sector creates greater value, the cost of the inefficiency is high relative to holdout problems from energy companies reducing the availability of permits to forest companies.
  - The availability and price of TDPs determines where energy firms will locate their exploration activities which has consequences for subsequent discoveries and exploration patterns
  - The more permits initially allocated to energy companies, the more old growth is conserved on the landscape because energy companies do not care about old growth per se, but forest companies want to harvest old growth first as it has the highest opportunity cost if left standing.

  - This effect is offset by an opposite fragmentation effect. The more permits initially allocated to forestry companies, the more contiguous the patches of remaining old growth. This may be an important tradeoff for certain ecological objectives

Conclusions

- MBIs could be a cost-effective way to meet regional cumulative effect targets for footprint on the landscape
- More work needs to be done linking forest management objectives to implementation options such as ecological equivalence metrics, initial allocation, etc. There is a need to be clear about ecological objectives for the forest before selecting the best implementation options.
- Need to understand more about how permit systems might interact with existing property rights, aboriginal and treaty rights, and existing resource rent policies.

A Case Study of Boreal Caribou in Northern Alberta

Why caribou?

- High-profile species
- Sensitivity recognized in the 1970s; have been gathering information on caribou ever since
- 3,000 caribou in 12 main herds; all main herds are in decline
- Wolf predation is hypothesized to be the main cause of these losses
- Historically caribou adapted to habitats where other herbivores (moose, deer) were rare and there was insufficient biomass to support wolf populations
- Landscape change has increased the amount of immature forest and seismic lines leading to an influx of deer and moose, and therefore an increased food source for wolves. This has increased the probability of encounters between wolves and caribou, with caribou being relatively easy prey
- There is a substantial difference in extirpation risk between herds
- Risk factors include, current rate of decline, size of herd and size of range, degree of past disturbance, density of white-tailed deer.

Recovery Strategies

- Recovery actions are nonlinear in their effectiveness, and timing is critical (i.e., some herds could be past the point of recovery)
- The current recovery program is mandated to recover all herds, which has led to a focus on herds that are most in trouble. But if conservation capacity is limited, efforts allocated to caribou herds with little chance of recovery may deprive healthier herds of the support they need to remain viable. This approach may result in the sequential extirpation of most or all herds in the province.
- Suggest an alternative approach based on optimized resource allocation. Conservation resources would be allocated with the aim of achieving the best overall conservation outcome, at the provincial scale. This may involve a triage system where herds are prioritized and resources are moved from weak herds to herds that are most likely to respond, and therefore maximize the potential for at least some herds to survive
- Current recovery strategies based on mitigating the effects of industrial activities within caribou ranges have not been effective. Habitat protection, augmented by habitat restoration and wolf control, will be required to assure the long-term viability of herds.

Comparison of Recovery Strategies

- Simulation results which compare habitat restoration (reclamation of seismic lines), habitat protection (no new industrial development), and wolf control show that in the absence of any intervention, functional extirpation of caribou will occur in about 30 years.2
- Costs of strategies vary significantly

[2] The simulation model uses a mathematical equation to make predictions about the caribou population, and incorporates the opportunity cost (i.e. foregone revenue from delaying or halting resource extraction) of habitat preservation, as well as the costs of restoration (reclaiming seismic lines) and wolf control. Note that the results presented here are just the first stage of a more detailed analysis on the costs and benefits of caribou recovery strategies.

  - Wolf control is relatively inexpensive (a few tens of millions) Restoration is more expensive (few hundred million)
  - Habitat protection is most expensive (billions), mostly because of foregone revenues from oil production. There cost of recovery varies greatly among herds
- Wolf control
  - Would require an 80% reduction in wolf numbers for good results
  - Difficult to get public support – unlikely to be palatable as the sole strategy
  - Long-term wolf control would reduce ecosystem integrity because of the wolf's important role as a top predator in the boreal forest.
- Habitat restoration
  - Unlikely to be successful in the absence of habitat protection (e.g., seismic lines would be used as access routes)
- Habitat protection
  - Fundamental requirement for long-term viability
  - Provides other biodiversity and social benefits
  - Only some ranges (e.g., those in the oilsands region) are very expensive to protect; others are very low cost. Moreover, industry has only limited capacity for development, therefore, up to a point the effect of protection is simply to shift development activity around the landscape and not to decrease the actual rate.

Conclusions

- Projected opportunity cost of recovering all herds using protection, restoration and wolf control likely exceeds amount that will be allocated for this purpose
  - Society may decide that we can afford to save all the herds, but history has shown that this is likely not the case
  - All herds are on public lands, so the trade-offs are all in the public domain
- Costs and recovery response between herds is highly variable
- The current recovery strategy increases the risk of extirpation of all herds by channeling recovery effort to herds that have the least chance for survival. Consider the idea of triage or prioritizing investments in herds with greatest viability for a given level of effort in order to maximize the overall conservation gain (e.g., save the most herds possible).
  - Triage: rank herds in terms of recovery priority and protect the ranges for as many viable herds as is affordable
  - Triage: only restore habitat in ranges selected for recovery
  - Triage: move conservation resources/capacity from weak herds to strong herds.
- There is a tradeoff at the metapopulation level between cheap (low cost) herds and strong (viable) herds:
  - Cheap herds are good because low costs allow more herds to be treated
  - Strong herds are good because they contribute more to the long-term viability of the provincial population
  - Decision regarding which herds to prioritize must include a careful analysis of both of these factors.
- Recovery strategies are amenable to an industry-led offset approach based on establishing a common funding pool that all firms pay into and then focusing

restoration efforts on selected ranges which have the highest probability of recovery given the resources available

Scientific uncertainty - the weak link

- Population viability is difficult to quantify as we must estimate the chance of a herd surviving for a period of time, and we have a limited understanding of how different variables (wolf population, climate change, etc.) affect outcomes

Panel 1. Challenges in Creating Markets for Ecosystem Services

What are the most significant challenges in creating markets for ecosystem services?

Ecosystem service markets are 'designer markets'

- Markets may be designed to solve a problem, but the problem they solve may not enable markets to function effectively. For example, the environmental complexity of the good being traded may reduce participation in markets or create monopoly power, eliminating the gains from a market based approach. On the other hand, reducing the complexity of the environmental problem so that the market functions may lead to environmental degradation and not addressing the problem or meeting society's environmental goals.
- Metrics are required to measure and compare the 'goods' being traded.
  - Metrics are typically a proxy that can be feasibly monitored and is often tied to activities of companies rather than the valued environmental outcome
  - Market based instruments become more expensive and difficult to implement when they are outcome based since outcomes generate complexity and are more difficult to measure. However there are greater ecological risks if metrics are not outcome based. There is a tradeoff between economic efficiency and environmental risk in the design of MBIs.
  - Accommodating heterogeneity is difficult but constructing a metric in the boreal forest where most of the land is still managed as forest may be easier than for agricultural regions with more habitat loss and fragmentation
  - Biology should drive the design of markets or other approaches.
- A variety of problems may exist in environmental markets including asymmetric information between market participants (resulting in negotiation and and coordination problems); scientific uncertainty, and barriers to market entry.
  - Environmental markets must be carefully tested to ensure that they can both maintain liquidity while still addressing the underlying conservation objective

Poorly defined property rights for ecosystem services

- Clear property rights for an ES must be defined before it can be bought/sold in a market. Problems in defining property rights for ES include: multiple ES provided by single management actions (bundling); ES are public goods so benefits to enjoy ES are non-exclusive; ES are provided by public lands owned by the Crown.

Limited Administrative Capacity

- Few government administrators understand the cost and profit drivers of firms which makes it difficult to design environmental markets (they tend to have complex rules and administrative requirements which reduces liquidity and benefits of trading)
- Design process becomes lengthy as consultation with a variety of individuals, agencies, and stakeholders is often necessary to generate support for substituting environmental regulation with environmental markets.

- Necessary information such as registration lists to find trading partners and successfully negotiate trades doesn't always exist
- Significant resources are required initially to set up a market based instrument

Lack of consensus on the use of markets

- Markets reveal a financial value and can change behavior through incentives or other actions however markets are not universally accepted by the public. Some economists think environmental taxes are more efficient than environmental markets

What special considerations arise in the case of ES from Forest Lands, and Public lands with multiple user case?

Rights to land

Aboriginal titles, forestry leases, and energy sector are all present on public land; even when government is the underlying title holder, it still has to negotiate with multiple groups representing different interests

Rights to sell ES

- Multiple ES markets on public lands can create coordination problems particularly when multiple ES are produced by single management actions, or (the opposite case) when ES have competing requirements.
- Carbon/forestry market example:
    1. Forestry as an industry has one of the greatest opportunities for carbon sequestration. Main strategy is avoided deforestation. However other options include increasing rotation ages, and increasing yields by changing species mix.
    2. Some actions to increase carbon stocks can have a positive impact on a number of other ES, while others such as actions involving intensive forest management and hybrid species may have a negative impact on ES
    3. The question of how to allocate ownership of carbon on public forest lands has not been resolved in Canada

What can we learn from US Conservation Banks?

- The current ES market system in the US is not perfect, but it is nevertheless working to some degree - conservation is happening, different groups are supporting it, and it seems to be more economically efficient than alternative approaches.
- In the US, the two major drivers of ES markets are the Endangered Species Act (ESA) and the Clean Water Act (CWA) which both allow/require offsets to meet regulatory requirements.
- Private-public partnerships like the Willamette Partnership are developing and piloting ecosystem credit accounting protocols
    - The protocols can be used to jointly calculate the number of water quality credits, wetland credits, etc.
    - Divide land into zones with a different types of credits assigned to each zone
- In the US much of the offset supply is generated by conservation banks (CBs)
    - CBs are large areas of preserved/restored habitat set aside to compensate for other impacts

- Protocols require formal approval from government agencies to ensure that offsets/credits can be sold
- There are 440 CBs in the States – 336 are commercial, the rest are publicly owned
- Ecological advantages to CBs:
  - Historically, on-site mitigation has failed to maintain ecological requirements. CBs ensure that regulated ecological requirements have been met at the time of development. Additional benefits include: large areas end up being preserved/restored; Areas are preferred if they are next to other good sites to allow for species movements
- Economic advantages to CBs:
  - Economies of scale: cheaper on a unit basis to do large sites
  - Liability: without CBs, the permit applicant is liable to ensure mitigation requirements are met. With CBs liability is transferred to bank sponsor
- Regulatory Components of CBs:
  - CBs are overseen by Federal and State agencies in the US
  - Must be consistent with state and federal guidelines
  - Focus is on protection and recovery
  - CBs are legal instruments to limit and lock in liability for ecological risk
- Ecological Challenges
  - Selection of metrics to ensure ecological equivalence
  - Difficulty linking metrics to ecosystem services
  - Differentiating regional versus individual project impacts and/or benefits
- Economic Challenges
  - Banking is expensive (particularly the land costs), especially when done over the long term; banking programs create assets (offsets) of considerable value. This value and management of the cost of environmental liabilities is what creates profitable opportunities for private conservation banks.
  - Lack of information about future demand and supply. Banks not sure what will drive future demand or where credits will be needed, while banks and permittees may have unrealistic expectations of credit prices over time.
- Regulatory Challenges
  - Ensuring perpetuity of CBs over time is also difficult
  - Tax treatment of banks
  - Regulating financial risks of banks
- Process Challenges
  - Multiple regulatory agencies involved in establishing CBs
  - State governments can include requirements above and beyond those identified by the federal government under the federal CWA and ESA.
  - Jurisdictional overlap - districts in one state may be managed by a corps in a different state
  - Requires expertise of a variety of individuals (interdisciplinary team of consultants, engineers, etc.)
  - Time requirements - setting up a CB is usually a 12-18 month process
  - Lack of consistency in credit assessments creates uncertainty in establishing banks and in the offset market

Panel 2. Risk and Liability within Markets for Ecosystem Services

What are the risks and challenges of In-perpetuity versus Temporary Offsets; of In-lieu Fees versus Banks?

In-perpetuity versus Temporary Offsets?

- The choice between whether to require temporary v. permanent offsets depends on the end goal and the nature of the environmental impacts
- Habitat offsets usually are associated with permanency due to time lags and uncertainty in creating habitat and the desire to ensure habitat requirements are met in perpetuity.
- For objectives such as air quality where reductions in emissions are more substitutable over time and space it may be beneficial to increase flexibility by allowing temporary offsets.
- It is important to design offset programs to allow for adaptive management and the ability to make changes.

In-lieu Fees versus Banks?

- There is nothing inherently wrong with in-lieu fees, however in practice when governments set in-lieu fees they tend to set prices incorrectly and underprice the true cost of an offset. This transfers financial and/or ecological risk for the offset to the public.
- Challenges with In-lieu Fees
  - The transfer of legal liability for environmental damages/offset is more challenging under in-lieu fees since there is no direct transfer of obligation between developes and offset providers.
  - It is also challenging to get the costs right when setting fees as the fees are not tied directly to the market signal.
- Challenges with Banks:
  - High cost of practice
  - Oversight and enforcement of banking agreements is inconsistent
- Both banking and in-lieu fee programs require better standards and regulation.

What are the financial risks associated with offsets and how can these be managed?

- Offset markets face normal business risks from changes in demand and changing costs (e.g. changes in land prices). However these are normal business risks and do not require government intervention.

- Government should be concerned with government-inflicted risks due to changes in regulation, and inconsistently applied assessments and rules.

- Banks should be required to put up short-term and long-term financial assurances before projects are approved
  - Short-term assurance: make sure bank has the funds necessary to operate

  - Long-term assurance: an endowment or money put into an escrow account should an act of god occur
  - Provides assurance that bank exists in perpetuity

- Ensure banks have a long-term monitoring and maintenance agreement
  - Monitoring should be done on an annual basis
  - Must be able to show that you have performed the mitigation (e.g., vegetation must survive) in order to receive credits
  - No rule about who must do monitoring; monitors can be contracted/selected through a bidding process

What are considerations for managing offset liability between buyers, sellers, and government?

- Need a well defined chain of liability and ownership which transfers environmental liability between developers, banks, and government. Registries are necessary to ensure someone is responsible for managing the environmental outcome.
- Need to decide whether the ultimately responsible for offset liabilities should rest with the public or with private agencies. In-lieu fees paid to a government agency tend to transfer liability to the public
- CBs transfer liability from offset buyers to offset sellers. Buyers are at risk if the offset fails; that is, between the time that the offset is created and the offset credit is extinguished. If the offset falls through, or if no offsets are available, the development project may be delayed or cancelled.
- Insurance backing for CBs is very expensive, and getting insurance while maintaining profitability in private CBs is challenging
- Government may assist in managing risk by holding offsets in reserve and having companies set aside reserve funds which can be used to purchase new offsets in case an offset fails.
- Government can help manage risks by overseeing the system and take the role of the offset administrator
  - Government could provide financial security in the financial payment process
  - Government could provide monitoring services for the offset banking agreements (i.e., verify that the management actions are being undertaken and/or that the management outcome has been achieved)
  - Government may monitor compliance of banks to rules and regulations

How can price uncertainty and long run credit costs be managed?

- Banking of credits
  - Introduces time flexibility
  - Can reduce perverse activities (like drilling simply because your credits are about to expire)
  - Need to keep good information on the banked credits

- Price uncertainty and long run credit cost
  - Information about trades and prices is critical in managing price uncertainty

- Allow selling into the future. Creating income today from credits that will be established in the future shares risk of price uncertainty between buyers and sellers
- ES markets may be subject to price bubbles (like other asset markets). May be worthwhile to investigate ways to design ES markets to minimize bubbles

Panel 3. Designing Robust Markets for Ecosystem Services

What are the roles of banks, brokerages, auctions and centralized exchange in facilitating transactions and procuring ES?

Brokerages

- Brokers provide information in markets that are quite specialized, and manage economies of scale and risk between buyers and sellers
- If many brokers show up early on, it may signal that the market is too complex

Exchanges

- Where people buy and sell things
- Information regarding "willingness to pay" and "willingness to accept" between buyers and sellers is usually withheld; An exchange is a place which provides information as well as a space for buyers/sellers to negotiate.
- Do not necessarily need a centralized exchange, though it may be valuable in some circumstances (e.g., thin markets, early stage markets, or markets for complex products where search and negotiation costs are significant).
- Smart markets such as Bush Broker in Australia are assisted by computer programs that bring buyers and sellers together and ensure that all the rules and requirements for buyers and sellers are met before a transaction can occur.
- Either the government or the private sector can act as an exchange

Auctions

- Can be useful in creating market liquidity
- Governments or private agencies can pool many small in-lieu payments and hold a reverse auction for offsets
- Auctions are not always necessary, depends on the context.

What factors influence market participation?

- Greater information increases participation. Information requirements include; clear rules about transfer of liability; and availability of information about opportunities, trades, and prices
- Simplicity of rules increases participation though complexity is often necessary to manage ecological risks. Markets should be designed so that the complexity delivers on desired ecological outcomes and that costs of setting up the market match the social value of market
- Credit for early action increases participation
  - Excluding those who act early sends the wrong message to people who have been doing environmentally friendly activities for a number of years
  - Providing credit for early actions avoids perverse incentives to destroy habitat in order to maximize potential gains from restoration.
- Any form of regulated market that overlaps with a prior developed voluntary market is likely to destroy the voluntary market, unless the goods are different, in which case the two markets might coexist

How should markets for multiple ecosystem services be coordinated?

Credit stacking from multiple ES markets is controversial

- If different management actions deliver different outcomes there is no coordination problem – the markets are naturally separated.
- Separate markets increase transaction costs therefore there is a role for government or another agency (e.g. an exchange) to assist in coordinating offsets packages
- If one management action delivers multiple environmental outcomes then the question arises as to whether landowners should be allowed to stack credits from different markets. There are two offsetting issues in determining whether or not to allow credit stacking.
    - Some landowners will be able to 'double-dip'; i.e., get paid twice for management actions that they would already have been willing to undertake with just one market. This could violate the principle of additionality.
    - On the other hand there will be some landowners who won't participate if they can't collect multiple credits because they can't recover full costs in just a single ES market even though the net social benefits from the land are positive
    - Credit stacking should not be an issue if the ES markets are 'sequential', in which case there would be no incentive for an agency (private or public) to pay a landowner for an action which is already being undertaken. It is only an issue if farmers are selling in multiple ES markets simultaneously.

Panel 4. Perspectives on Policy Implementation in Alberta

Overarching policy framework

Alberta Land Stewardship Act (ALSA)

- Lots of uncertainty when legislation was created in terms of what instruments might be implemented in Alberta. ALSA creates fundamental "enabling" building blocks which can be used in the design of MBIs
  - Defines "stewardship unit" as the metric which can be used to define offsets or tradable commodities
  - Defines the role for an exchange as a mechanism to link buyers and sellers
    - Meant to educate participants, provide information to individuals wishing to enter the market

Regional Plans

- Regional plans will be used to set objectives and to guide the design of mechanisms to achieve objectives

Policies being Explored for Boreal Forest Conservation

- Conservation offsets
  - Definition of offsets under ALSA is fairly broad
    - Enables both permanent and temporary offsets
    - Challenge will be to operationalize with definitions of conservation, protection, enhancement, etc.
- Tradable disturbance permits
  - Main challenge: translating the concept from academic conversation to an applied real-world setting

Alberta Biodiversity Monitoring Institute data and options for defining ES metrics and equivalence

Species Level Intactness Metrics as proxies for ecosystem services

- Intactness indices assess similarity between different habitat sites from a biotic perspective
- Within a region, you can determine how intact an area is (i.e., how similar a species' real abundance is to the expected abundance under pristine conditions)
- Intactness indices consider the deviation of a site in reference to another site of interest; and account for spatial location and its impact on ecological similarity including how species assemblages differ at different locations.
- It is possible to compare intactness at different spatial scales including at the site level and the regional level to determine ecological equivalence between impacts and offset benefits
- The system that can track changes in cumulative effects over the landscape

Panel 5. Participant Response

What are the key lessons you/your agency have learned over the last day?

- Conversation about offsets is progressive
- Resources should flow into highest value conservation actions
- CBs are good at generating offsets
- ALSA is powerful legislation that can enable market based instruments to be developed in Alberta
- People still need to know what role they can play in conservation markets (forestry groups, conservation groups)

What additional steps/challenges do you see in creating offset markets in Alberta?

- Concern about complexity of issues
  - Need to be careful in designing these instruments so that they don't discourage productive conservation actions (pursuit of the perfect over the good)
  - Understand scientific need to be careful however it might take too much time and may be too complex but should be opportunistic to some degree
  - Need to figure out how to determine the quantity of offsets required (e.g., based on acres disturbed)
  - Site specific conservation actions need to be balanced against cumulative effects issues on the broader landscape
  - We should recognize that we have hit and exceeded an ecological threshold; need to be talking about how to get back under the threshold
  - Government should be requiring offsets, even if they're only at a coarse-level
  - Public and private enterprise need to work together on these issues

- Transparency in markets and policy development
  - Concern about letting one group design things alone; need to integrate ideas from all relevant disciplines and stakeholders
  - Most important thing to do is continue to exchange ideas, with everyone focusing on what they're able to contribute
  - Forest industry can be viewed as a vegetation management industry that can be used to meet multiple resource management objectives (including conservation objectives) on forest lands
  - Need to continue discussions between economists and biologists/ecologists, as offsets are not being discussed by the latter group
  - Government should be involved in regulating the market

Presentations

12/9/09

OVERVIEW OF SFMN RESEARCH ON INCENTIVES AND ECONOMICS OF BIODIVERSITY CONSERVATION

December 3, 2004

Vic Adamowicz, *University of Alberta*
Marian Weber, *Alberta Research Council, University of Alberta*

Sustainable Forest Management Network

- Research Projects
  - Partners
    - Research questions – RFP
    - Participation in research program
    - Knowledge Exchange
  - Interdisciplinary
  - Policy / Problem Oriented
- State of Knowledge Projects
- Capstone Projects

SFMN projects on incentives and the economics of biodiversity conservation

- **A bioregional assessment of sustainable forest management for the boreal plains**
- **Ecological and economic tradeoff analysis of conservation strategies for Woodland Caribou herds in Alberta.**
- ***Natural Capital and Ecosystem Service Valuation as a Tool for Sustainable Forest Management.***
- **Incentive policies for sustainable forest management**

Tradeoffs between forestry resource and conservation values under alternate forest policy regimes: A spatial analysis of the western Canadian boreal plains

Boreal Ecology and Economics Synthesis Team (BEEST)

Investigators:
- Vic Adamowicz
- Fiona Schmiegelow
- Steve Cumming
- Marian Weber
- Grant Hauer
- Lee Foote
- Stan Boutin
- Fred Burnett
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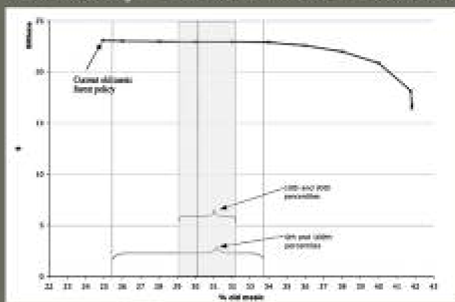
Partners:
- Alberta Sustainable Resource Development
- Alberta Energy
- Alberta Environment
- B.C. Ministry of Forests
- Ducks Unlimited
- Alberta-Pacific Forest Industries
- Canadian Forest Products (BC)
- Weyerhaeuser Company
- Millar Western

Funded by the Sustainable Forest Management Network

Locations of Forest Products Mills

Biodiversity – Forest Product Tradeoffs

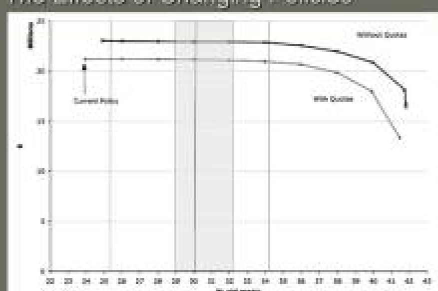


Source: Hauer et al 2007

Percent old forest – with no constraints

Percent old forest – with 44% constraint

Biodiversity – Forest Product Tradeoffs
The Effects of Changing Policies



Ecological and economic tradeoff analysis of conservation strategies for Woodland Caribou

Investigators:
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- Steve Cumming
- Fiona Schmiegelow
- Marian Weber

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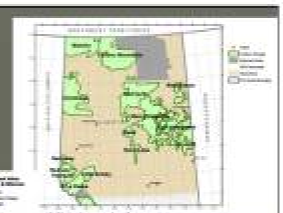
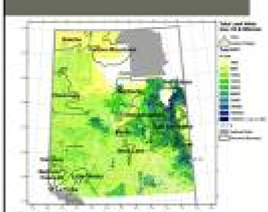
- Michael Hadrychun
- Robert Jagodzinski
- Diane Lee
- Pearce Shewchuk

Partners
- Government of Alberta
- Environment Canada
- Government of Yukon
- Treaty Eight First Nations
- Ducks Unlimited
- Alberta-Pacific Forest Industries
- Tembec Inc.
- Weyerhaeuser Company
- Tolko Industries
- DMI
- West Fraser Timber Company
- Tolko
- AFPA
- Linkages to CAPP & ESCC

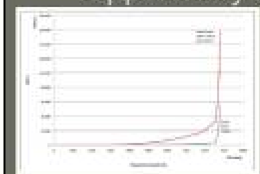
Caribou Project Objectives

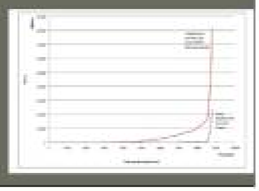
- At least 4 landscape level management actions have been proposed in response to declining caribou numbers:
  - Limiting industrial footprint in areas occupied by caribou,
  - Altering the industrial footprint to discourage predator and alternate prey use,
  - Culling of predators, and
  - Increasing hunter harvest of alternate prey. (e.g. moose, deer)
- Our objective is to identify tradeoffs and evaluate the cost effectiveness of alternative caribou management / recovery actions.
  - Find "least cost" approaches to meet conservation goal
  - Timing of actions, combinations of actions
  - Linking ecological and economic systems
- Develop framework for evaluation of benefits of management actions and distribution of benefits





Opportunity Cost Analysis





Natural Capital: Using Ecosystem Services Valuation and Market Based Instruments as Tools for Sustainable Forest Management

Researchers
- Vic Adamowicz (U Alberta)
- Marian Weber (ARC, U Alberta)
- Stewart Elgie (U Ottawa)
- Nathalie Chalifour (U Ottawa)
- Mike Howlett (SFU)
- Jay Anderson (U Alberta)
- Carla Gomez W. (U Ottawa)
- Geoff McCarney (U Alberta / Columbia U)

Partners
- Alberta SRD
- Ontario MNR
- Treaty 8 First Nations
- Environment Canada
- DMI
- Tembec
- DU
- NAFA

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Capstone Project

- Illustrate and synthesize the various innovative policy options for participants;
- Learn about government priorities with respect to forest management
- Review lessons on implementation from other jurisdictions
- Articulate the opportunities and barriers to the various approaches, and identify priorities for moving these policies forward.

Incentives for SFM 2005-2008

Research Team
- Marian Weber (ARC/UofA)
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- Stan Boutin (UofA)
- Peter Boxall (UofA)
- Steven Kennett (CIRL)
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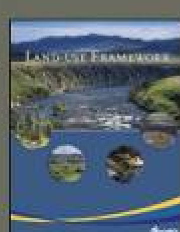
- Hamed Kaddoura (UofC)

Partners
- AlPac
- Alberta Environment
- Sustainable Resource Development
- Environment Canada
- Little Red River Tall Cree
- Ducks Unlimited Canada
- Canadian Boreal Initiative

The Alberta Context

- **Land Use Framework Conservation and Stewardship Tools**
  - "Cumulative effects management will be used at the regional level to manage the impacts of development on land, water and air."
  - identify and develop a toolkit of new best practices, market-based approaches and incentives to provide ecological goods and services;
    - Tradable Disturbance Rights (TDRs)
    - Land conservation offsets
  - ***Alberta Land Stewardship Act* (Bill 36)**



http://www.landuse.alberta.ca/documents/Final_Land_use_Framework.pdf

Institute for Agriculture, Forestry and the Environment

- The IAFE's mandate is to catalyze and coordinate the development of a policy framework that harness market forces to improve environmental performance in the renewable resource sector. It has four strategic mandate areas:

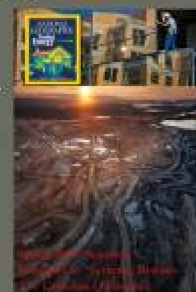
1. **Develop a Conservation and Stewardship Strategy**
2. **Market-Based Approaches for Environmental Stewardship**
3. **Documenting Environmental Integrity**
4. **Innovation**

Incentive Project Goals and Activities

- Identify incentive policies applicable to Alberta's boreal forest through synthesis of existing information on incentive based policies globally, and an experts/partner workshop.
- Quantitatively explore outcomes of incentive programs through experimental methods and simulation models.
- Identify institutional feasibility of incentive programs including legal constraints and requirements for implementation, and integration of First Nations rights and obligations.
- Identify opportunities for aboriginal communities to use incentive programs to develop new markets and/or livelihoods from environmental services.
- Identify public preferences for different incentive programs using a structured survey ("choice experiment") involving partners and other stakeholders.

Background

- Most of AB's forest allocated in FMAs/FMUs
- AAC calculated without attention to fire or energy sector impacts
  - In 1999 the total harvested area for industrial roundwood = 42,210 ha.
  - Between 1995 and 2002, the average annual area cleared by the energy sector = 47,000 ha
- Reclamation Deficit
- Problem throughout Western Sedimentary Basin



Need for new approaches …

- Project Specific Approvals versus Cumulative Effects
- Move towards threshold based land management plans
  - Deh Cho (NWT); Muskwa-Kechika Management Area (BC)
  - Alberta Land Use Framework
- How to translate objectives into project specific approvals and requirements
  - Zoning can lead to significant political lobbying
  - Fairness and cost effectiveness?

What are Market Based Instruments (MBIs)

- Policy instruments that use price or other economic variables to provide incentives to manage for the environment.
  - encourage an environmental improvement where there are private costs to land managers but greater public benefits
  - discourage environmental degradation when there are private benefits to land managers from damaging practices but even greater public costs
- Price Based Incentives
  - taxes, charges, subsidies
- Quantity Based Incentives (Proxy Markets)
  - Tradable Disturbance Permits
  - Offsets

http://www.marketbasedinstruments.gov.au/

When are Proxy Markets Appropriate?

- Large variations in the ability and cost-effectiveness of actions by firms to provide the desired conservation outcome.
  - market instruments can be used to reveal cost-effective opportunities
- Flexibility in the range of responses that will deliver the desired outcome;
- Scope for innovation in improving land management outcomes.
- There is a known, established and enforceable objective, target, threshold

Variability Costs and Effectiveness of Action

- Forest Sector
  - Change timing and pattern of block layout
  - Coordination on roads, etc. (Integrated Land Management)
  - Site heterogeneity of stand values (age, site quality, distance from mill, etc.)
- Energy Sector
  - Reducing the width of seismic lines, roads per well, Increasing the number of wells per pad
  - Reclaiming disturbed land faster
  - Best practice options and impacts are resource/site specific.

Requirements of Quantity Based Systems

- A quantitative environmental performance target to be achieved individually or collectively
  - a maximum ceiling on activity
  - a minimum performance commitment
- A defined spatial and temporal flexibility.
  - Requires a well defined environmental equivalence to enable transfers of permits
- Monitoring and Verification System

Tradable Disturbance Permits

- Cap Annual Forest Disturbance (ha/yr).
  - Permits issued for use in a given year (grandfather/auction)
- Firms must hold permits (TDPs) for forest disturbance
- Permits can be traded between sources.
- In theory reduction of disturbance occurs in areas where it is most cost effective

Offset Program

- An offset is a positive action to compensate for the negative environmental impacts associated with development.
- Associated with No-Net Loss or Additionality Requirements
  - E.g. Firms required to maintain certain amount of undisturbed forest on the landscape
  - Firms can 'buy back' allocations or create credits through reclamation/restoration to meet this target
- Environmental outcome depends on definition of 'equivalence'

Evaluation Criteria

- Environmental Effectiveness
- Cost Effectiveness
- Economic Efficiency
  - maximizing benefits/minimizing cost;
- Administrative Feasibility; and
- Equity and stakeholder acceptability

Program Characteristics

	Cap and Trade	Baseline and Credit	Offset
Program Goal	Disturbance Threshold	Encourage Best Practices	No Net Loss
Definition of the Good	Amount of Disturbance	Amount of Disturbance	Ecological Equivalent
Property Right	Allowance	Allowance	Obligation
Spatial Dimension	X	X	Y
Baseline Requirements	X	Y	Y
Fungibility	H	M	L

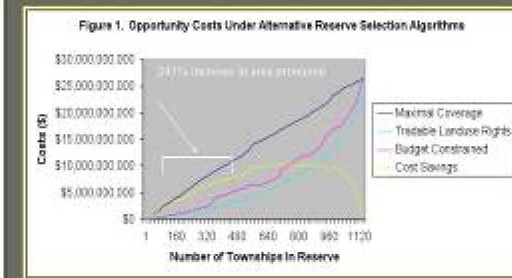
Design Options

- Setting Objective and Cap
- Initial Allocation
- Banking
- Market Institution

Design Options

- Setting Objectives and Defining Right
  - Instrument = Coarse Filter
    - Old Growth, All Disturbance, Zoning (ecologically sensitive areas?)
  - How does the coarse filter relate to biodiversity objectives
  - How to incorporate successional dynamics and shifting habitat features into conservation objectives and TDPs;
  - Tradeoffs between spatial and non-spatial aspects of biodiversity conservation;

Design Options

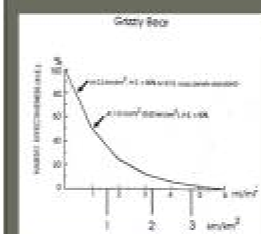


Design Options

Table 2. Outcomes Under Alternative Reserve Selection Approaches

Approach	Land Constraint	Cost ($M)	Biodiversity Index
MC	140 twps (~12%)	$3,410	.076
BC*	173 twps (~15%)	$807	.076
TLR	140 twps (~12%)	$555	.056
TLR	200 twps (~18%)	$917	.081
TLR	480 twps (~42%)	$3,340	.195
MC	380 twps (~34%)	$9,360	.190

Design Options

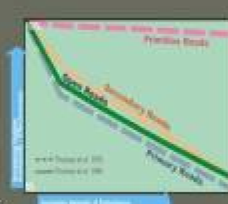


- Dose Response Functions for species of mammals, fish, birds
- Integrated Indices such as Biodiversity Intactness underway
- Can these be used to set caps or define habitat equivalence

Source – AEP 1998

Design Options

- Features vary in impact and duration
  - Linear Features
  - Roads
  - Mining
  - Cutblocks



- How can we make these "commensurable"

Design Options

Initial Allocation/Market Institution

- Grandfathering
  - Permits grandfathered based on historical rights/use
  - Firms trade *on an open market*
  - Firms trade permits *on a sealed market*
- Government Auction
  - E.g. Sealed bid (e.g. used in government tenders or timber sales)
  - Revenue Neutral – revenue redistributed back to firms based on proportional share of timber
- Banking or No Banking

Design Options

- Rigid Institution
  - In the initial period allocate number of permits available in each period based on the expected fire damage
- Adaptive Institution
  - CAP is adjusted in each period according to impact of fire
    - Large fires (> expected) – reduce cap
    - Small fires (< expected) – increase cap

Testing Design Options

- Experimental Analysis
- Agent Based Modeling
- Assumptions
  - Forest contains forest and energy firms
  - Both types require disturbance permits to access resources
  - CAP on amt of Old Growth disturbance
  - TDP is not tied to a specific site.
  - Without cutting constraints each forest company would manage its stands according to Faustmann model
  - Energy company search pattern not tied to value of timber

Experiments

- 42 Experiments carried out with UofA students
- Data
  - Alberta Forest Management Units (FMUs) based on 2001 Vegetation Inventory
  - AEUB drilling data
  - Fire – mean annual burn rates per "period" (40 years) of 11.5%
  - Random burn applied by FMU (1-45% FMU burned per period)
  - 9 forest companies and 3 energy companies
  - Forest agent revenues
    - Produced Net Revenue Values based on yield curves and inventory for each FMU
    - transportation and harvest costs for each FMU
  - Energy agent revenues
    - Value of Energy TDP set arbitrarily 30% higher than forestry values
    - Independent of forest revenues

Experiments

- Results show Major difference between market institutions is in control over the permits
  - Affects the efficiency, environmental, and distributional consequences
  - Double Auction and Call Market are equivalent to an offset market (trading entitlements)
  - In the case of tender auctions firms cannot hold back permits

Agent Based Model

- Use ABMs to capture complex dynamics
  - Heterogeneity of agents (within/between sectors)
  - Interdependencies (across space and time)
- Captures learning and spatial interaction
- Reflects dynamics of energy sector

Agent Based Model

- Results show initial allocation affects landscape metrics
  - The amount of old growth in any period depends on how many permits are allocated to forest companies.
  - If energy companies must purchase permits from forest companies, this affects the location of their search activity and thus key landscape features; also is costly in terms of search pattern
  - Initial allocation to forest companies only – results in less old growth initially (energy company doesn't value old growth per se); increased variation in mean patch size, and greater clustering of old growth (proximity to mills)
  - Total amount of old growth is highest when the energy sector receives all of the permits

Conclusions

- MBIs may be a fair and cost effective way to manage cumulative effects and meet regional land use targets on public land;
  - Overlapping tenures and cross-sector challenges
  - More work required to understand tradeoffs amongst design options (e.g. defining objectives, disturbance thresholds and metrics, market mechanisms) and preferences for policy options
  - More work required on implementation
    - Distributional and equity issues
    - Overlapping tenures and coordination between industrial sectors
    - Aboriginal treaties and rights

Acknowledgements

- Sustainable Forest Management Network
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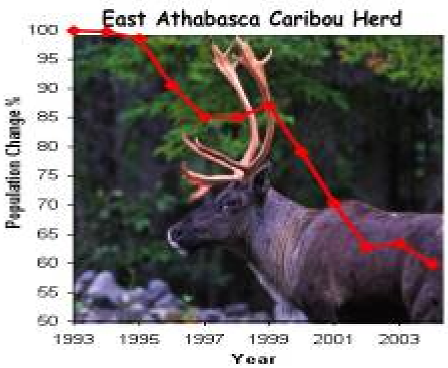
- ALCES Group

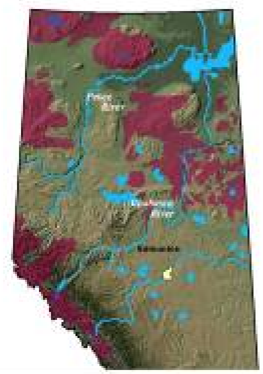
Boreal Caribou Case Study

Richard Schneider
Grant Hauer
Vic Adamowicz
Stan Boutin



Woodland Caribou in Alberta

- ~3,000 caribou in 12 main herds
- All monitored herds in decline



Woodland Caribou in Alberta

- Wolf predation identified as the main proximal factor in caribou decline. Rate of pregnancy and calf production ok.
- Leading hypothesis = loss of spatial separation:
  - industrial disturbance in/around caribou habitat—>
  - influx of deer and moose —>
  - increase in wolf population —>
  - increased rate of wolf-caribou encounters and kills.

Current Recovery Efforts

- Reduction of existing industrial footprint
- Reduction of future industrial footprint
- Reduction in predation (wolf kill)

- Recovery program is mandated to recover all herds in the province, though efforts have focused on herds perceived to have a high risk of immediate extirpation

The Problem

- Conservation capacity may be inadequate.
- Focusing resources on the least viable herds may deprive stronger herds of the resources they require to maintain viability.
- The consequence may be the sequential loss of herds, including herds that may have had a reasonable chance of survival.

Our Simulation Model

Three components:

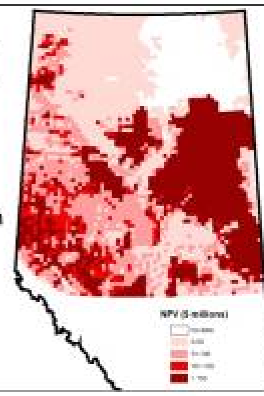
- Habitat restoration (reclamation of seismic lines)
- Habitat protection (prohibition on new industrial activity in caribou ranges)
- Wolf control (reduce wolf population within caribou ranges by 80%)

Other Management Options

- Empirical data for modelling unavailable.
- After 30 years of caribou management involving industry guidelines, best practices, and various restrictions on activities, Alberta's woodland caribou are now among the least viable in Canada and are closer to extirpation than they ever have been.

Economic Model

- Net present value model (oil, gas, forestry) by Grant Hauer et al.
- Costs of restoration and wolf control from Alberta case studies



Ecological Model

Population model: Track the state of each caribou herd over next 50 years, accounting for wolf control and the restoration of seismic lines.

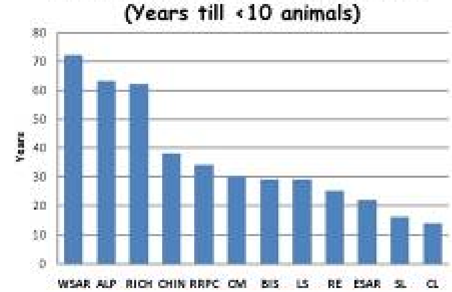
Annual population growth rate =

1.0184 - 0.0234 * linear feature density - 0.0021 * percent young habitat

[Sorensen et al. (2008), updated]

Projection of Current Trends

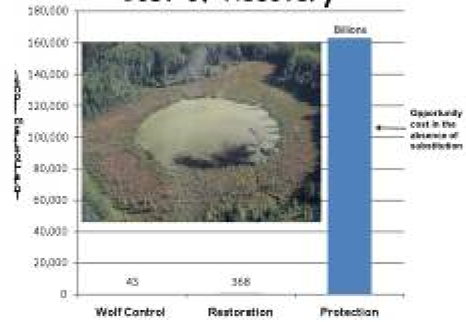
(Years till <10 animals)



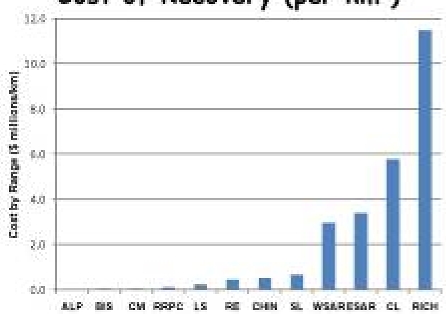
Simulation Results

- With optimistic parameters (best case), half of the simulated herds became self-sustaining in 20-30 years. The other herds became self-sustaining in year 36, which is when the replanted seismic lines reached crown closure.
- In most other scenarios, only four herds became self-sustaining within the 50-year model run.

Cost of Recovery

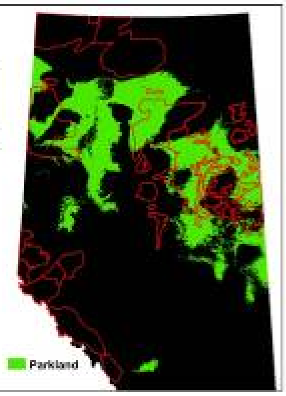


Cost of Recovery (per km²)



Parkland climate in 2050

(Schneider et al., 2009)



Caribou Range vs. Agriculture

(proxy for deer immigration pressure)

Herd Rankings

Factor	Best Herds				Worst Herds			
Recovery cost per km²	ALP	BIS	CM	RRPC	RICH	CL	ESAR	WSAR
Current population trend	WSAR	ALP	RICH	CHIN	CL	SL	ESAR	RE
Range size	CM	CHIN	RE	WSAR	CL	RICH	LS	SL
Linear disturbance	ALP	RRPC	CM	RICH	BIS	LS	CHIN	SL
Years till self-sufficiency	ALP	RRPC	RICH	WSAR	Tie: LS, BIS, CHIN, SL, ESAR, RE			
Distance to agriculture	RICH	WSAR	BIS	RRPC	SL	CL	CM	LS
Climate change	Tie: RRPC, ALP, BIS, CM, RICH				WSAR	ESAR	RE	CHIN

Conclusions

1. The projected opportunity cost of recovering all herds exceeds the amount that might realistically be approved for this purpose.
2. Situation is critical and immediate action is required. Sequential recovery not an option.
3. Herds vary greatly with respect to cost and response to recovery efforts. This variation provides a rational basis for the differential allocation of recovery capacity.

Recommendations

- Consider the implementation of a triage approach: aim is to optimize the allocation of available conservation resources relative to a defined outcome.
- New conservation objective required:

  Old objective: recover all herds

  New objective: maximize the long-term viability of the provincial metapopulation

Implementation

- Recovery capacity is insufficient
- Recovery actions are nonlinear in their effectiveness and timing is critical
- Triage is not simply about picking winners and losers. It is also about redirecting resources that might have been expended on herds with little chance of survival to herds with greater viability, in order to *maximize overall conservation gain*.

Wolf Control

- Cost is not a limiting factor (few 10s of $millions)
- Need 80% reduction for good results
- Difficult to achieve and maintain public support; resistance increases with duration and spatial scope
- Reduced ecosystem integrity
- Triage: only apply wolf control in ranges selected for recovery

Habitat Restoration

- Costly (few hundreds of $ millions)
- Unlikely to succeed in the absence of habitat protection
- Triage: only apply restoration in ranges selected for recovery
- Amenable to an industry-led offset approach (e.g., establish a common funding pool but focus efforts on selected ranges)

Habitat Protection

- Costly (opportunity cost of $billions)
- Protection is a fundamental requirement for long-term viability (+ provides other biodiversity and social benefits)
- Caribou ranges are all on public lands, therefore, trade-offs all in public domain
- Triage: rank herds in terms of recovery priority and protect as many as you can afford to. No protection of other ranges.

Sub-Range Protection

- Use caribou habitat as the unit of selection for triage, instead of entire caribou ranges.
- Benefit is that substantially more caribou habitat could be protected for the same total cost by actively selecting lower cost habitat units (e.g., townships) over higher cost units.
- Work in progress

Minimum Range Size

- The key to caribou viability is predator avoidance, not simply hectares of suitable forage. Large contiguous tracts of land may have to be protected to prevent infiltration by predators from surrounding areas.
- Also, no indication that caribou will concentrate in limited portions of their range, so it may not be possible to "pack" individuals into subsections of the total range.

How Many Herds?

- Fundamentally a function of conservation capacity, a societal tradeoff decision
- Also depends on the cost per herd, which is a function of recovery methods and intrinsic herd factors
- Metapopulation viability tradeoff:
  - Cheaper herds are better because you can protect more of them
  - 'Strong' herds are better because they are more likely to survive

Tradeoff Summary

Resource Allocation — Risk

↓

Recovery Methods — Risk

↓

Selection of Herds (cheaper vs. stronger) — Risk

Ecological Outcomes: The Weak Link

- Population viability can't be meaningfully quantified (and metapopulation viability is even harder).
- If proxies are used, *need to think carefully about what is really being optimized*. May be trading off one form of risk for another, or increasing overall uncertainty.
- Need to consider broader tradeoffs (e.g., protecting peatlands vs. old forest)

Ecosystem services and markets: Developing a multi-ecosystem service marketplace

Robert Deal
Research Forester and Science Team Leader
USDA Forest Service, PNW Research Station
Portland, Oregon

Overview, definitions and concepts

- Discuss market-based approaches for ecosystem service markets (ESM).
- Current and emerging markets for ESM.
- Concept of bundling of ecosystem services.
- Describe framework for an Integrated Ecosystem Services Accounting System.

Ecosystem services are "the benefits people obtain from ecosystems"

ECOSYSTEM SERVICES	
Supporting Services Nutrient cycling Soil formation Primary production	**Provisioning Services** Food (crops, livestock, wild foods, etc.) Fiber (timber, cotton/hemp/silk, wood fuel) Genetic resources Biochemicals, natural medicines, pharmaceuticals Fresh water
	Regulating Services Air quality regulation Climate regulation (global, regional, and local) Water regulation Erosion regulation Water purification and waste treatment Disease regulation Pest regulation Pollination Natural hazard regulation
	Cultural Services Aesthetic values Spiritual and religious values Recreation and ecotourism

Source: Millennium Ecosystem Assessment, 2005

Ecosystem Services Markets in the U.S.

- Water quality trading
- Wetland mitigation
- Species conservation banking
- Carbon credits
- Voluntary markets: biodiversity credits and ecosystem services etc.

Ecosystem Service Markets

- Scarcity equals value
  - 50% of US wetlands drained.
  - Majority of ESA listed species on private lands.
  - Water quality and quantity; and carbon, climate and greenhouse gas emissions.
  - Ecosystem services markets: water, carbon and biodiversity 'produced' by intact ecosystems have financial value.


Wetland mitigation and species conservation banking
Clean Water Act (Section 404)
Avoidance and minimization, then mitigation.
Credit ratio (currency value) and service area (watershed).
Over 500 banks now in operation.
USFWS guidance 2003, CA guidance 1995
Private property owners receive financial returns in exchange for protecting rare species.
Conservation banks already protect nearly 25 endangered species and cover some 40,000 acres.


Water Quality Trading Activity
State or Regional Trading Policies
One-Time Offset Agreements
Ongoing Offset/Trading Programs
Other Projects and Recent Proposals


Willamette Valley, Oregon


Carbon and forestry

Carbon and forestry

Sustainable Forest Management can best contribute to reduction of atmospheric carbon by:

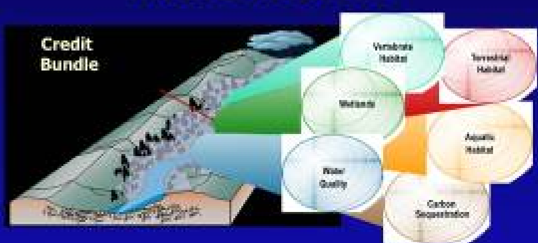
- Maintaining Forest Stocks
  - Keep Forestland in Forest Use
  - Reforestation
- Increasing Forest Stocks
  - Afforestation
  - Active Management to Increase Growth Rates
  - Rotation Age
- Sustainable Production of:
  - Forest Products
  - Bioenergy, biofuels, biochemicals

TERRESTRIAL OFFSETS: POTENTIAL

Terrestrial Offset Projects Have High Sequestration Rates And Are Among The Lowest Cost Offset Opportunities

Activity	Representative Carbon Sequestration Rate in U.S. (Metric tons of CO2 per acre per year)
Afforestation	2.2 – 9.5
Reforestation	1.1 – 7.7
Avoided Deforestation	83.7 – 172.1
Changes in Forest Management	2.1 – 3.1
Reduced Tillage on Croplands	0.6 – 1.1
Changes in Grazing Management	0.07 – 1.9
Cropland Conversion to Grassland	0.9 – 1.9
Conservation of Riparian Buffers	0.4 – 1.0
Wetlands	0.5 – 2.5
Avoided Grassland Conversion	0.9 – 1.9

Bundling ecosystem services to increase forest value



Northwest Partnerships

- Counting on the Environment- (Willamette Partnership) primarily focusing on regulated markets.
- http://www.willamettepartnership.org/
- Marketplace for Nature consortium primarily focusing on voluntary markets.
- http://www.defenders.org/programs_and_policy/biodiversity_partners/ecosystem_marketplace/mfn/index.php

Willamette Partnership- Counting on the Environment

- Development of a ecosystem credit accounting protocol for four ecosystem service markets:
- Water quality trading
- Wetland mitigation
- Salmonid habitat
- Prairie habitat

Willamette Partnership- Counting on the Environment

- Accounting tool to quantify and measure conservation and restoration activities.
- Landowners can calculate credits for multiple services and then choose among zones to generate individual credits.
- Suitable to the site.
- Provides connectivity among services.
- Sustainable over the long term.


Willamette Partnership-
Counting on the Environment
Ecosystem Credit Accounting System supported by virtually every federal and state regulatory agency:
Federal: NRCS, USFS, EPA, NOAA, USFWS, Corps of Engineers
Oregon: ODOT, DEQ, ODF, State lands, Agriculture, ODFW
Cities and NGOs: Albany, Eugene, TNC, Defenders, Clean Water Services, Freshwater Trust, many others…


Thanks for your attention…

Conservation Banking Basics

Craig Denisoff
Vice President

Preserve the past.

Protect the future.

WESTERVELT ECOLOGICAL SERVICES

U.S. Environmental Setting

- History of Environmental Laws: 1960-1970's
  - "Acid Fog" - Clean Air Act
  - "Rivers on Fire" - Clean Water Act
  - "Symbols of American Wildlife going Extinct" – Endangered Species
- 1980-1990's
  - Development of environmental regulations and policies
  - "Lots of sticks, few carrots"
  - "Winning the battle, but losing the war"
- 1990-2000's
  - **"Acceptance of the currency" Wetland Delineation Manual**
  - "No Net Loss" Policy
  - Mitigation Banking policy (1995) and Rule (2007)
  - Conservation Banking policy (California 1995), U.S. 2003

Primary Sources of Demand for Species Mitigation:

- Federal Endangered Species Act
  - Section 7
  - Section 10

Florida Panther
USFWS Photo

Other Sources of Demand:

- State Endangered Species Laws
- State Environmental Quality Acts
- Local agency policies and ordinances

Swainson's Hawk

ESA Permitting

- Biological Assessments
- Critical Habitats Designations
- Biological Opinion
  - Jeopardy
  - No Jeopardy
- Impact Reduction
  - Avoidance
  - Minimization (BMP's)
  - "Conservation Measures" to avoid jeopardy
    - Mitigation

Burrowing Owl

Early Species Mitigation

The Conservation Banking Concept

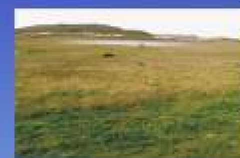
- Conservation Banks: Large areas of preserved and/or restored species habitat set aside to compensate for impacts to similar species
- Ecological Advantages:
  - Large preserve size
  - Species Connectivity
  - Biological Performance Standards
  - Land Stewardship
  - Species Protection/ Recovery

Coastal Sage Scrub

The Conservation Banking Concept

Economic Advantages:

- Severance of Liability
- Economy of Scale
- Lower Mitigation Ratio
- Reduces Permit Review and Uncertainty



Barry Jones Wetlands Mitigation Bank

Conservation Bank Components

- Approval by a Conservation Bank Review Team (typically federal and state wildlife agencies)
- Consistency with the federal guidance for Conservation Banks (May 03) and/or State laws
- Implement species protection and recovery
- Conservation Bank Agreement establishes bank operation and implementation

Conservation Bank Agreement Components

- **Legal Binding Agreement Establishing Bank Owner and Agency Responsibilities**
- **Bank Information:** Location, Acreage, Species, Number of Credits, Bank Owner and/or Sponsor
- **Biological Components:** Service Area, Performance Standards, Biological Monitoring, Habitat Mitigation and Monitoring Plan, Site Construction and Credit Phasing (if appropriate)
- **Legal Requirements:** Legal Liability, Conservation Easement, Deed Restrictions, Grantor Deed
- **Financial Requirements:** Easement and Long-Term Management Endowments, Contingency Security

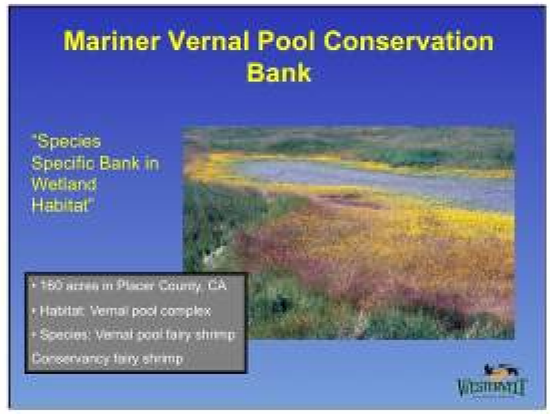
Conservation Bank Focus

- Preservation and recovery of species rather than "no net loss"
- Preserving high quality habitat
- Protecting/Restoring areas adjacent to source or core populations
- Service areas tied to species range
- Wildlife corridors and biological connectivity
- Long-term stewardship

Conservation Bank Examples

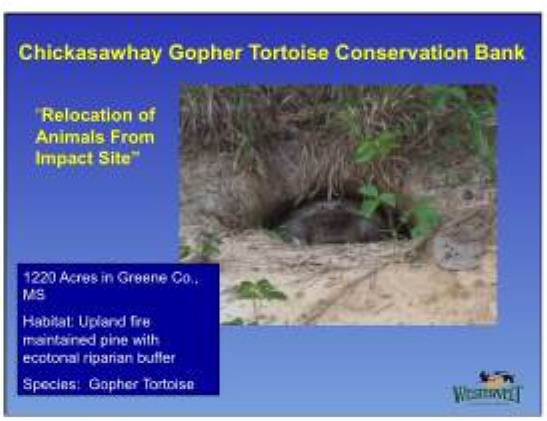
San Joaquin Kit Fox


Coles Levee Ecosystem Preserve
"First Formal Conservation Bank"
• 6059 acres in Kern County, California
• Habitats: alkali playa and valley saltbush scrub
• Species: San Joaquin kit fox, Tipton kangaroo rat, giant kangaroo rat, blunt-nosed leopard lizard and other species
WESTERVELT


Mariner Vernal Pool Conservation Bank
"Species Specific Bank in Wetland Habitat"
• 160 acres in Placer County, CA
• Habitat: Vernal pool complex
• Species: Vernal pool fairy shrimp
Conservancy fairy shrimp
WESTERVELT


Kimball Island Mitigation Bank
"First Fisheries Bank"
• 104 acres at the confluence of the Sacramento and San Joaquin Rivers, Sacramento County, California
• Habitats: riverine aquatic bed, riparian forest, tidal perennial marsh, and shaded riverine aquatic
• Species: Delta smelt, Sacramento splittail, steelhead, and Chinook salmon
WESTERVELT


Sutter Basin Conservation Bank
"Create Wetlands for Species Only"
Concept Plan
Open Water, Wetland and Upland Habitat
• 429 acres adjacent to Feather River Bypass in Sutter County in in the Sacramento Valley of California
• 390+ acres of giant garter snake habitat
WESTERVELT


Chickasawhay Gopher Tortoise Conservation Bank
"Relocation of Animals From Impact Site"
1220 Acres in Greene Co., MS
Habitat: Upland fire maintained pine with ecotonal riparian buffer
Species: Gopher Tortoise
WESTERVELT


Biological Considerations of Conservation Banking
– Species on the edge of extinction can't be mitigated (e.g., Blanding's turtle, Ottawa)
– Definition of sub-populations may limit service area
– Relocation/Propagation: Good or Bad?
– Restoration: "If you build it, will they come?"
– Controlling Non-native/Predatory Species
WESTERVELT

Economic Considerations of Conservation Banking

- Land Costs
- Long-term Management Costs
  - Conservation easement and land management accounts (Endowments)
- Regional mitigation practices vary
- Typically lower profit margin than wetlands (e.g., less value added)
- Dynamic nature of listing and de-listing
- No timelines for bank review

Regulatory Considerations of Conservation Banking

- Conservation Banks new concept in many states/countries
- No specific requirement in ESA statue requiring "mitigation" from species/habitat impacts
- How to coordinate Habitat Conservation Plans w/ Conservation Banks
- Opportunity to obtain permanent land protections versus temporary BMP's, etc.

Conservation vs. Mitigation Bank Comparison

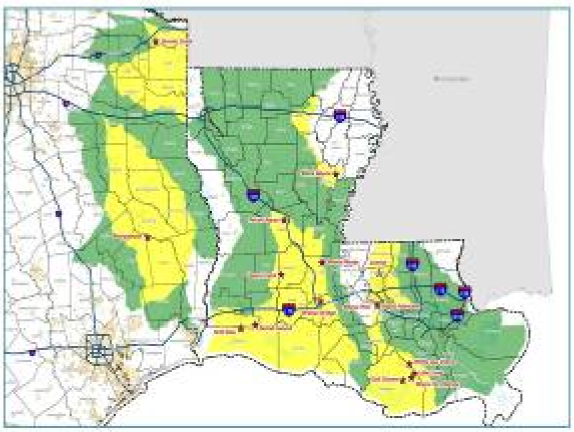
Conservation Bank	Mitigation Bank
Endangered Species Act	Clean Water Act
CB Guidelines (03')	Mitigation Rules (08')
Recovery of Species	No Net Loss
Preservation of existing species habitat	Restoration or creation of wetlands
Long-term stewardship and species occurrence	Habitat restoration and function and values

Forested Lands/Public Lands

- Forested Lands:
  - Potential to focus on unique forest ecosystems (e.g., Redwood forests of Northeast)
  - Species related to those forest habitats
    - Example of Gopher Tortoise conservation bank
- Public Lands
  - Substantial opportunity to use public lands to provide ecosystem offsets
  - Issues:
    - Public subsidizing private development/habitat loss
    - Baseline or value added from using existing habitat
    - Land use provisions related to public lands (e.g., recreation, tax revenues, etc.

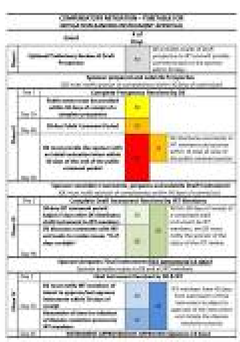

SFMN Workshop
Challenges in Creating Markets for Ecosystem Services
Russ Krauss, Resource Environmental Solutions LLC


Resource Environmental Solutions LLC
A Complete Wetland Mitigation Solution Provider
– Wetland Mitigation Banks
– Ecological Restoration Services
Founded February 2007
– 4 business entities with a commitment of $25 million in institutional capital (pension funds)
– 12 mitigation banks, more in the approval process
– Across 11 watersheds
– Over 14,000 acres of property
– Nearly $125,000,000 in wetland mitigation credits
– Louisiana and Texas and growing
Resource Conservation Fund now raising $200 million from pension funds

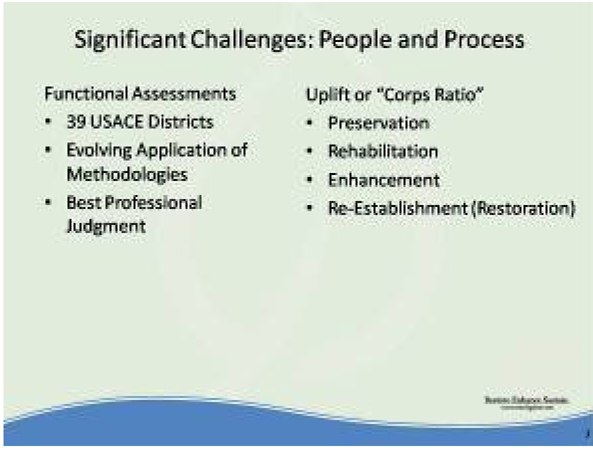



Significant Challenges: People and Process
Roles & Responsibilities
• Regulatory Agencies
– USACE
– IRT Members
– State and Local Government
• Mitigation Bankers
• Permit Applicants
Key Influencers/Advisors
• Engineering and Environmental Consulting Firms
Enabling Legislation
• Clean Water Act Section 404
• Rivers and Harbors Act Section 10
• WRDA of 2007
➢ Indicated regulators' preference for mitigation banks
• "Final Rule" on Compensatory Mitigation June 2008 (USACE,EPA)
➢ Still "New"


Compensatory Mitigation
✓ Mitigation Bank
• In Lieu Fee
• Permittee Responsible Mitigation

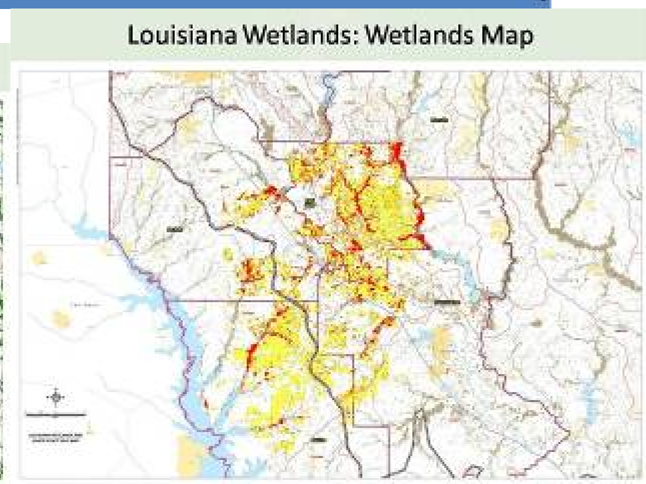


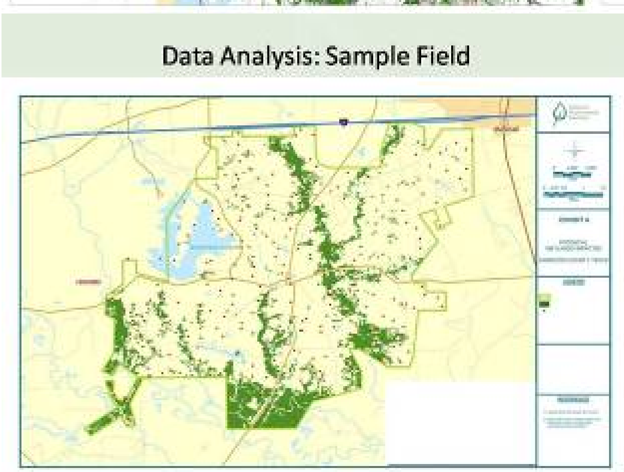

Legend

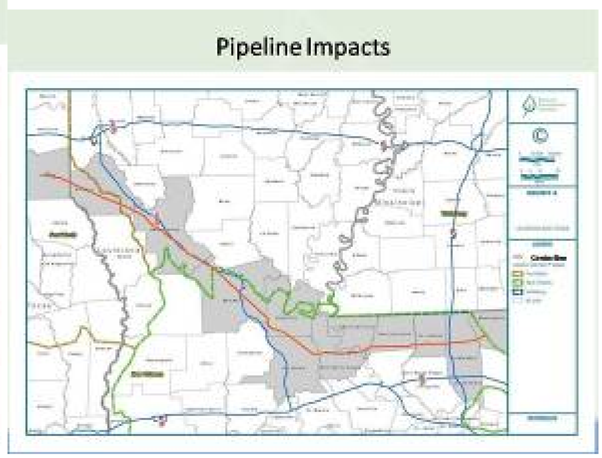

Significant Challenges: People and Process
Functional Assessments
39 USACE Districts
Evolving Application of Methodologies
Best Professional Judgment
Uplift or "Corps Ratio"
Preservation
Rehabilitation
Enhancement
Re-Establishment (Restoration)

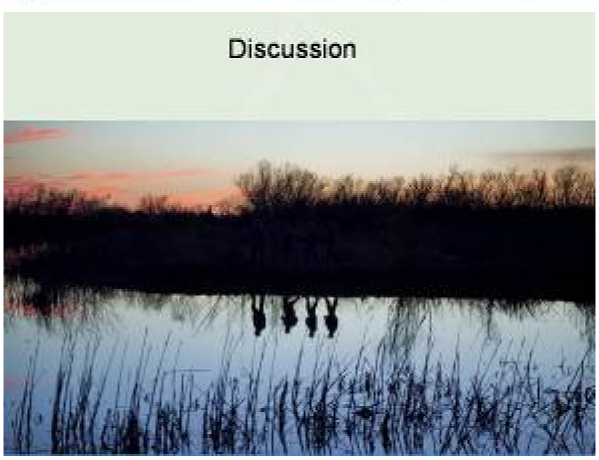

Significant Challenges
Supply
Mitigation Bankers
Wetland Mitigation Credits
Right Watershed
Right Type
Right Price
Availability
Demand
Project/Development-Driven
Instant Access
Necessary Part of Overall Capital Project
No Planning
Multiple Regulators
Unrealistic Expectations of Credit Prices Over Time
Lack of Credit Supply


Louisiana Historical Wetlands: Hydric Soil Map


Louisiana Wetlands: Wetlands Map


Data Analysis: Sample Field


Pipeline Impacts


Discussion

CHALLENGES IN CREATING MARKETS FOR ECOSYSTEM SERVICES

Stuart Whitten
CSIRO Sustainable Ecosystems

Difficulty #1: Design to minimise market failures (and government failures!).

Rights	Unclear definition or allocation Difficulty in defining or measuring good / service
Asymmetric information	Buyers don't know private costs of changing management
Asymmetric information	Landholders don't know public benefits from changing management
Information failure	Landholders may not be familiar with tools and techniques to change management
Scientific uncertainty	Insufficient knowledge about the relative and absolute impacts of landuse change
Difficulty measuring / monitoring success	Outcome known later but costs incurred upfront. Difficult to monitor implementation / effectiveness.
Constraints to market entry	Payments don't match capital constraints or costs of making a bid prohibitive
Market power	Small numbers of participants, collusion, or dominant players.

Difficulty #2: Rights/entitlements to underpin markets

- What: unique commodity (e.g. Carbon)
- Quantified: measurable at reasonable cost
- Ownership: clear and enforceable (excludable)
- Valuable: worthwhile to define and enforce
- Transferable: feasible and low cost
- Risk: good science (link to ecosystem service) and secure from government intervention

Difficulty #3: Describing a suitable metric

- We need a metric that reflects the ecosystem service goal (sometimes termed fungibility).
- The metric is the measure of what is being bought and sold in the market.
- It is THE critical element in evaluating alternative actions / purchases.

Difficulty #4: Capacity to design/administer

- Understanding the concept and its application.
- Knowing what and how to implement.
- Designing appropriate systems and processes.
- Resources to support implementation and administration

- Few government people involved know much about how business operates – this is a big constraint if you are designing and implementing markets!

What really matters in metric design?

Where to target the metric:

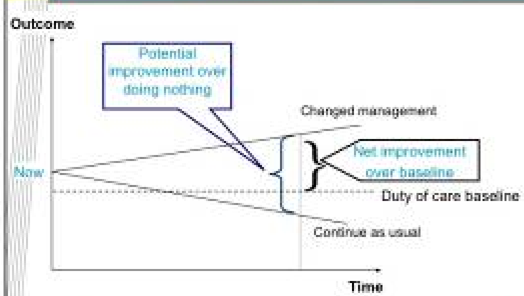
- Inputs / Actions → Modelled outcomes
- Outputs → Modelled outcomes
- Outcome proxy → Part of outcomes
- Outcomes → Outcomes

What really matters in metric design?

Where to target the metric – biodiversity:

- Inputs / Actions → Fencing, weed control etc.
- Outputs → Habitat in good condition
- Outcome proxy → Birds breed successfully
- Outcomes → Full complement of biodiversity retained

Additionality



Nine key elements of metric design

1. Quantity / quality ➢ Hectares or more complexity?
2. Spatial relations ➢ Does spatial configuration matter?
3. Relative change ➢ Marginal improvements matter
4. Location ➢ Up/down-stream / distance to benefit
5. Timing ➢ Years to achieve outcome
6. Implementation risk ➢ Failure to change management
7. Outcome uncertainty ➢ Desired outcome does not result
8. Irreversibility/thresholds ➢ What happens if nothing is done?
9. Spillover impacts ➢ Will the solution create problems?

Key concepts for market design: Service equivalence

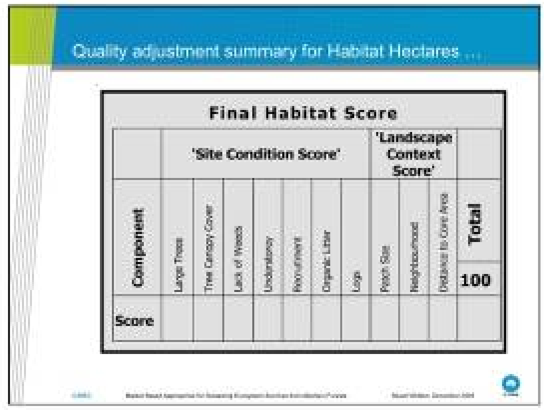
What do these mean in practice?

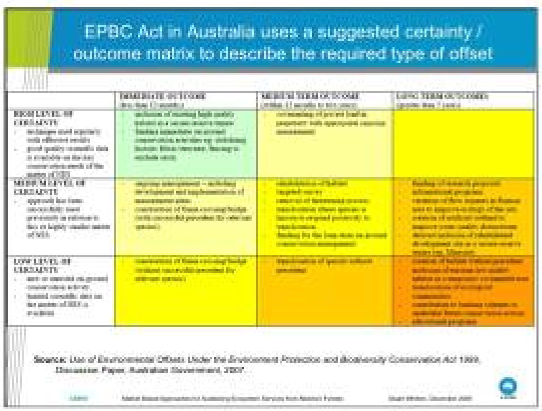
Service equivalence and offset markets

- A key difficulty (and cost) is ***measuring*** service equivalence.
- Some ways to think about this:

Strict like for like (local – same for same)	Habitat A (damage site) = Habitat B (offset)
Quality adjusted like for like (local – condition/security)	$H_A = H_B$ (quality/security adjusted)
Functional equivalence (Can include indirect offsets)	$H_A = H_B = f(X_1, X_2, X_3, \ldots, X_n)$
At least – metric based (simplifies measure and method where few trades likely)	$H_A < H_B$
At least – expert opinion based (offset is greater than damage)	Evaluation panel opinion is that $H_A < H_B$


Giant Garter Snake Habitat
WILDLANDS


Quality adjustment summary for Habitat Hectares …
Final Habitat Score
'Site Condition Score'
'Landscape Context Score'
Component
Large Trees
Tree Canopy Cover
Lack of Weeds
Understorey
Recruitment
Organic Litter
Logs
Patch Size
Neighbourhood
Distance to Core Area
Total
100
Score


EPBC Act in Australia uses a suggested certainty / outcome matrix to describe the required type of offset
IMMEDIATE OUTCOME
MEDIUM TERM OUTCOME
LONG TERM OUTCOMES
HIGH LEVEL OF CERTAINTY
MEDIUM LEVEL OF CERTAINTY
LOW LEVEL OF CERTAINTY
Source: Use of Environmental Offsets Under the Environment Protection and Biodiversity Conservation Act 1999, Discussion Paper, Australian Government, 2007.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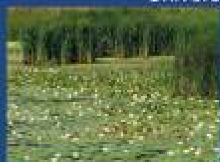
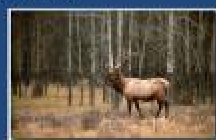
Factors Influencing Markets for Ecosystem Services

Amy W. Ando
Department of Ag. and Consumer Economics
University of Illinois





ILLINOIS

Introduction

- Challenge: Foster growth/development while protecting environment
- Externality problem(s):
  - Agents don't bear full costs of environmental damage
  - Agents don't reap full benefits of careful resource stewardship
- Regulation/restrictions can → perverse incentives, costly political battles (e.g. ESA)

- Market mechanisms can help environment in cost-effective manner, e.g.
  - SO_2 tradable permits
  - Individual tradable quotas in halibut fishery
- Optimal program design depends on features of the ecosystem service
- Some factors that influence market design:
  - Transaction costs
  - Heterogeneity
  - Spillovers between parcels
  - Presence of multiple ecosystem services

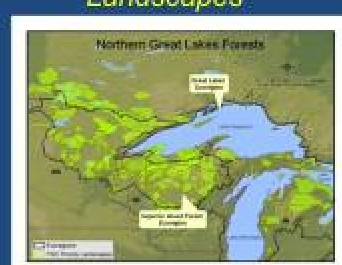
Transaction Costs

- Transaction costs can kill a market
- Poster child: water-quality trading in U.S.
- Examples of such costs:
  - Costly/impossible measurement
  - Steep learning curve for service provision activities
  - Risk
  - Restrictions on permitted trades
- Lowest costs are in a commodity exchange market – not always possible
- Need to balance necessary complexity with limiting transaction costs

Heterogeneity

- Parcels likely to vary in ecosystem-service provision for given practice
  - Biodiversity: some lands are more important habitat
  - Water filtration: same BMP accomplishes more if near river, more valuable if upstream
  - Location of sequestered carbon doesn't matter, but some lands may have more potential

Example: TNC Priority Forest Landscapes



Source: http://www.northeasternforests.org/FRPC/

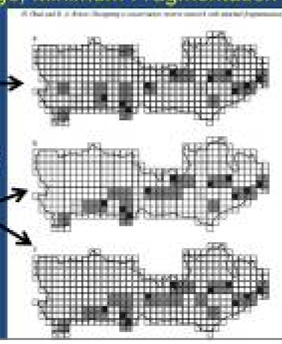
- Coping with heterogeneity
  - Could offer varied payments if levels of service provision could be measured
  - Simpler: Use zones between which trading and/or offset ratios are not 1:1
    - Priority vs. non-priority habitat
    - Riparian vs. non-riparian farms
- Danger – excessive restrictions can…
  - Yield thin markets
  - Limit potential for beneficial trades
  - Shut down market entirely

Spillovers Among Service Providers

- Ecosystem service flows on one parcel can depend on land use on neighboring parcels
  - Habitat benefits are often higher if lands are not fragmented
  - Erosion control from practices on one parcel depend on plant cover of upslope parcels
  - Carbon sequestration probably does not have big spillovers
- How can we cope with spillovers when they really matter?

Species Coverage, Minimum Fragmentation

- Just species coverage
- These two add constraints of minimum fragmentation

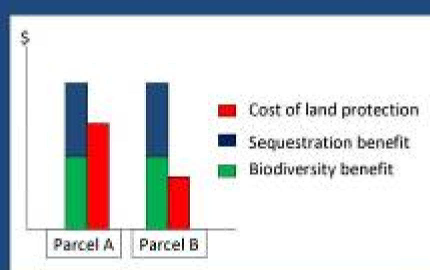


- Decentralized: offer prices to individuals that depend on land use of neighboring parcels
  - Literature on "agglomeration bonus"
  - Works in theory, hasn't been tried in practice
- Work with aggregating intermediary
  - Buyers purchase regional levels of ecosystem service – e.g. reduced total stream loadings
  - Aggregator contracts with individual sellers to achieve those levels
  - Aggregator absorbs risk, lowers transaction costs
  - Possible problem: If aggregator sells at P=AC (not P=MC), outcome may not efficient

Multiple Ecosystem Services

- Good stewardship can provide multiple benefits on a single parcel
  - ex: reforestation → CO_2 sequestered, wildlife
- Should sellers be allowed to reap multiple payments for a single activity?
- Tradeoff – multiple payments will
  - Ensure socially beneficial stewardship occurs
  - Give more money than "necessary" to some sellers; could try to reduce with bidding to provide bundles (e.g. CRP)
- Never good to pay twice for exactlysame service

Tradeoffs in Stacking Payments



Program Evaluation

- Is the market for ecosystem services "working"?
- Serious challenge – hard to measure levels of ecosystem service flows
- Need big baseline of data for measurement
  - Compliance costs
  - Environmental quality

- Biggest challenge: get the counterfactual right
  - Compare actual outcomes to what they would have been during the recent time period without the program
  - Ex: Elk may be affected by climate change at same time. Program might have helped even though elk populations declined
  - Ex: Land values might have risen. Even if compliance costs higher than expected, program might have helped reduced costs

Conclusion

- Great potential for ecosystem service markets to provide widespread and cost-effective environmental benefits
- Markets must be defined carefully – every service is different
- Don't let the perfect be the enemy of the very good

Ecosystem services as a planning framework for management of public forests in the USA

Robert Deal
Research Forester and Science Team Leader
USDA Forest Service, PNW Research Station
Portland, Oregon

Using Ecosystem Services as a Framework for Forest Stewardship

A collaboration between the Deschutes National Forest and the USFS Pacific Northwest Research Station

Dale Blahna, Robert Deal, Jeff Kline, Trista Patterson, Tom Spies
PNW Research Station
Cindy Glick
Deschutes National Forest
Nikola Smith
Presidential Management Fellow

Deschutes National Forest Project

- Why is there interest in this ES framework?
- New approach for multiple resource management.
- Public demand for natural resource stewardship.
- Multiple benefits that forests provide to public.
- Integrates commodities including timber and water with less apparent benefits (e.g. climate regulation, soil productivity, carbon sequestration, wetlands, recreation, and wildlife and fisheries habitat).

Building a New Language for Management: An Ecosystem Services Framework

Project Goals

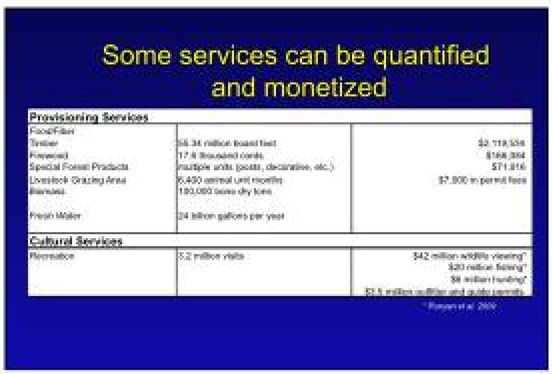
- Articulate the values that the forest provides to the public.
- Evaluate effects between management actions and the sustainable delivery of ecosystem services.
- Build ecosystem services-based partnerships to design and fund needed work on the ground.
- Create analytical tools that allow managers to assess project outcomes and tradeoffs in ecosystem services terms, i.e., across resource areas and over longer time scales.

Place-Based Approach

- 1.6 million acres along the east side of the Cascade Range in Central Oregon
- Diverse landscape, multiple climatic gradients
- 350 species of fish and wildlife, including the Northern Spotted Owl
- History of fire suppression
- One of the most heavily-used forests for recreation in the Pacific Northwest


Balancing Objectives


Define ecosystem services in National Forest terms.


Some services can be quantified and monetized
Provisioning Services
Food/Fiber
Timber
55.34 million board feet
$2,119,536
Firewood
17.8 thousand cords
$168,394
Special Forest Products
multiple units (posts, decorative, etc.)
$71,816
Livestock Grazing Area
6,400 animal unit months
$7,500 in permit fees
Biomass
180,000 bone dry tons
Fresh Water
24 billion gallons per year
Cultural Services
Recreation
3.2 million visits
$42 million wildlife viewing*
$20 million fishing*
$8 million hunting*
$2.5 million outfitter and guide permits


Others are described qualitatively


Drawing connections between Forest Service management and delivery of ecosystem services
❑ Restoration of aspen, meadows, marshes, wetlands and stream channels.
❑ Culvert replacement to facilitate fish passage.
❑ Tillage treatments to restore soil porosity.
❑ Road restoration and decommissioning.
❑ Removal of invasive species.

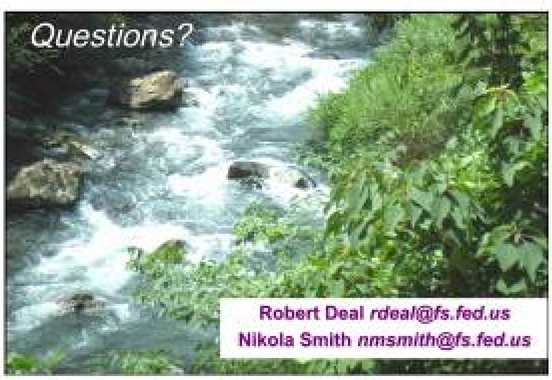

Who benefits from Forest Service management actions?
Who shares common interests in ecosystem service provision?
CENTRAL OREGON INTERGOVERNMENTAL COUNCIL
AMERICAN FORESTS
NATIONAL WILD TURKEY FEDERATION
NATIONAL FOREST FOUNDATION
The Nature Conservancy
afc


Making an Ecosystem Services Framework Operational
Concepts will be included in forest plan revision
Offers a new way to frame and present information in the NEPA process


Develop guidelines for applying ecosystem services to address:
Describing the portfolio of services in a landscape
Defining desired conditions in terms of sets of services
How to set priorities and evaluate various benefits on a given site
Presenting tradeoffs and synergies


Demonstration Project


The benefits of an ecosystem services approach to management
An integrated approach - allows managers to assess the costs and benefits of projects across resource areas and beyond forest boundaries.
Creates awareness about the services provided by public lands and brings attention to under-valued projects.
Leverages partnerships and funds to implement work needed on the ground.


Questions?
Robert Deal rdeal@fs.fed.us
Nikola Smith nmsmith@fs.fed.us

SFMN Workshop

Risk and Liability within Markets for Ecosystem Services

Russ Krauss, Resource Environmental Solutions LLC

Restore.Enhance.Sustain.

Challenges, Risk & Liability

Mitigation Bankers

- Execution Risk
  - Operational
- Financial Risk
  - Operational
  - Servitude
  - Monitoring
  - Regulatory
    - Short Term
    - Long Term

Permit Applicant

- Project Risk
  - Go or No Go
  - At What Cost
- Start Early
- Liability Transfer

What was a Cost of Doing Business
has evolved to
How Do We Do Green Business?

Restore.Enhance.Sustain.

RISK AND LIABILITY WITHIN MARKETS FOR ECOSYSTEM SERVICES

SFMN Workshop, Alberta, Canada

Veronika Nemes, PhD
Senior Economist
Environmental Economics Unit
Environmental Policy and Climate Change Division
Victorian Government Department of Sustainability and Environment

Purpose of offsets scheme

- To **address the trade off between economic development and environmental protection**.
- To include the environment in economic analysis and **to allow environmental values to compete on equal grounds with economic benefits**.
- To **support the establishment of the system of environmental accounts** that incorporates environmental losses and gains at a state/national level.

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In perpetuity versus temporary offsets?

- Victorian native vegetation offset model:
  - **Security gain is in perpetuity** (i.e. covenant is placed on the land title and it prevents the area to be cleared)
  - **Offset gain is temporary** (i.e. improvement in vegetation condition is guaranteed only for 10 years)

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Managing offset liability between buyers, sellers, and government?

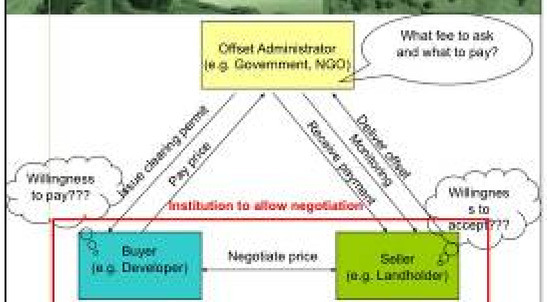
- What is the government's role in offset markets?

Simple goods

The offset market is more complex:

- Receipt of clearing permit is immediate but delivery of offsets is over a long period of time
- Financial payments is over time (maybe trust account is needed to hold money)
- Monitoring is required (buyer has NO incentive to do monitoring)
- Regulatory complexities (e.g. offset rules, 'no net loss' goal)

Environmental goods



In lieu fees versus banks?

- Buyers and sellers hold private information
- Buyers and sellers have no incentive to reveal this information
- Markets helps keeping prices competitive
- Prices negotiated depends on own effort, timing, and a range of market factors
- When prices are determined though markets, any changes in price over time is more acceptable than an in lieu fee change.
- "Offset administrator" will have difficulty representing both buyers' and sellers' side.

Financial risks associated with offsets?

- **Normal business risks** (outside of the scope of gov't)
  - Demand changes over time
  - Supply changes over time
  - Price drops/increases over time
  - "Forward production"
- There are business processes and financial risk hedging instruments available to achieve optimal exposure.

Financial risks associated with offsets?

- **Gov't inflicted risks**
  - Change in rules
  - Change in regulation
  - Change or metric
- Change in regulation has an impact on property rights, the value of the credits and the competitiveness in the market.
- To reduce this type of risk, a long term stable regulatory environment is needed.

Role for insurance for managing offset risk?

- **Scientific modelling risk:** Environmental metric and offset rules achieve less/more offsets than thought/desired
  - Government to purchase/sell offsets (needs to recover the cost of this risk from the offset transactions)
- **Moral hazard:** Seller does not deliver the offset over time
  - Seller to pay for discrepancy or penalty
- **"Act of God":** Environmental disasters to destroy offsets
  - The change in probability of a disaster happening between clearing site and offset site needs to be considered (maybe in the metric?)

Panel: Designing Robust Markets for Ecosystem Services

Amy W. Ando
Department of Ag. and Consumer Economics
University of Illinois

Credit for Early Actions?

- Some worry that paying for early actions violates "additionality"
- BUT if you start paying other people for stewardship, can induce negative behavior (e.g. cut down forest to be paid for reforestation)
- Such payments increase budget cost of program, but don't much affect true cost of program – just transfers

Banks, Brokerages, and Exchanges Oh My

- These institutions can help to
  - Lower transaction costs
  - Manage risk
- They aren't appropriate for all ecosystem services
  - Work best for cases where "credits" are uniform in nature, can be sold as a commodity
  - Maybe good for sequestration, not so useful for habitat (heterogeneity, space matters, interactions between parcels)

What Affects Market Participation?

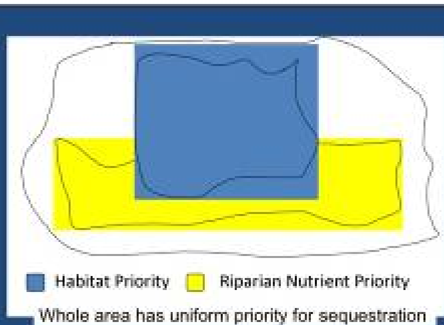
- Risk – no one likes it.
  - Sellers like certain payments
  - Buyers want to know they will be legally covered
- Cost – good idea to use technical outreach to reduce costs to suppliers of active stewardship with which they are not familiar
- Fear – is today's voluntary program tomorrow's regulation?

Price Uncertainty

- Fact of life! (look at corn)
- If want to reduce it, could:
  - Use government program to guarantee minimum payment to sellers
  - Encourage use of multi-year contracts that lock prices in for at least a few years
- It's possible that prices for different services don't move in the same direction – allows diversification

Coordinating Multiple Markets

- Be very careful about bundling!
- Some services should have heterogeneous trading ratios, others won't
- Could provide a multi-market information clearing house for buyers and sellers
  - Spatially explicit
  - Track current prices
  - Show priority/ratio/etc. for all services for lands in different zones

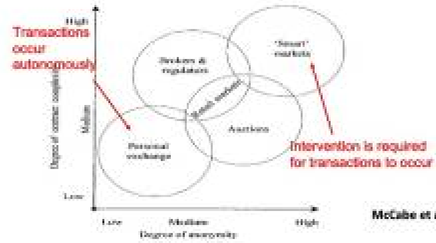


DESIGNING ROBUST MARKETS FOR ECOSYSTEM SERVICES

SFMN Workshop, Alberta, Canada

Veronika Nemes, PhD
Senior Economist
Environmental Economics Unit
Environmental Policy and Climate Change Division
Victorian Government Department of Sustainability and Environment

Roles of banks, brokerages, auctions and centralized exchange in facilitating transactions



McCabe et al (1999).

Factors influencing market participation

- Reduced regulatory complexity/red tape/transaction cost
- Use "smart market" design to enforce rules
  - Rules may need to be complex to safeguard the environment, computers can handle this
- Allow wide range of participants to enter the market to express demand for biodiversity (e.g. philanthropic organizations, NGOs) or supply of credits
  - Do not squeeze out the small buyers and sellers by high transaction costs.
- Provide purpose driven information not just data

Factors influencing market participation

- Harnesses market incentives
- Equitable and consistent in its application
- Transparency for current and potential market participants
  - See what buyers and sellers do
  - See what the government process is to change rules or modify conversion ratios, etc.
- Create confidence in process and rules

Price uncertainty

- Lots of different ways to manage price uncertainty.
- Lets look at it as a "forward production" or "lumpy asset" problem.
  - Future market.
  - Multilateral transactions.

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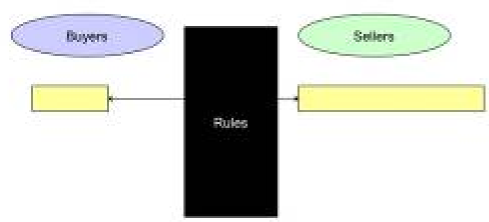
Lumpy assets



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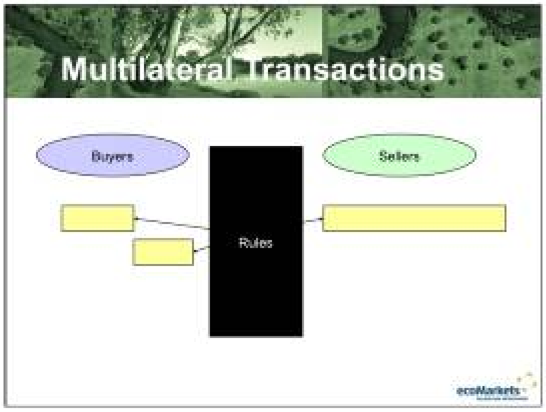
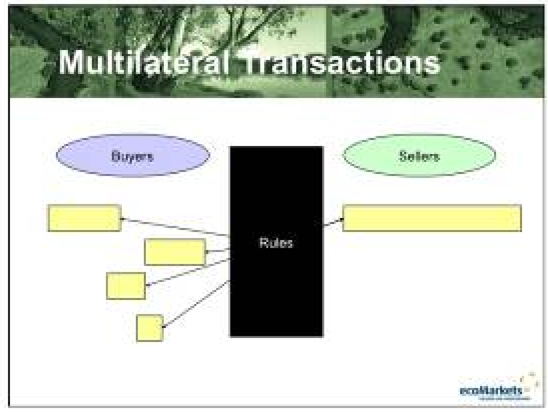
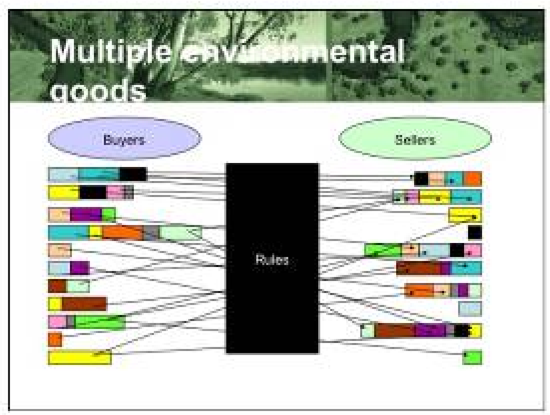
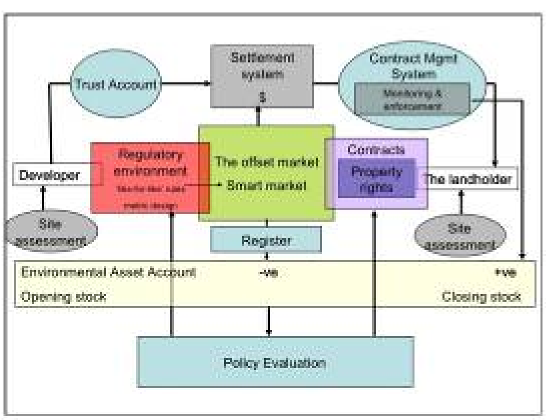
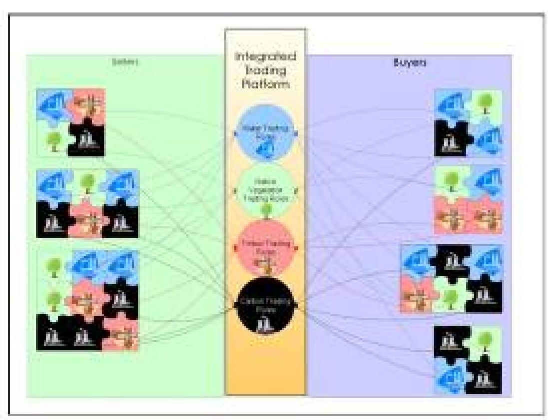

Multilateral Transactions
Buyers
Sellers
Rules
ecoMarkets

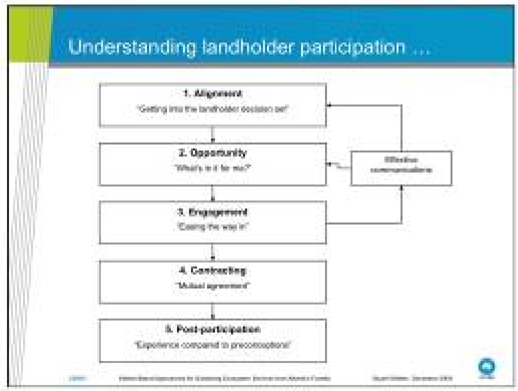

Multilateral Transactions
Buyers
Sellers
Rules
ecoMarkets


Transferability to other areas of environmental policy
• **Urban environment** a package may consist of:
– Nitrogen offsets
– Stormwater impact offsets
– Air quality offsets
– Vegetation offset (as amenity value), etc.
• **Rural environment:** a package on the buyer side may consist of
– Carbon
– Water quality
– Endangered species, etc.
ecoMarkets


Multiple environmental goods
Buyers
Sellers
Rules


Trust Account
Settlement system
$
Contract Mgmt System
Monitoring & enforcement
Developer
Regulatory environment
The offset market
Smart market
Contracts
Property rights
The landholder
Site assessment
Register
Site assessment
Environmental Asset Account
-ve
+ve
Opening stock
Closing stock
Policy Evaluation


Sellers
Integrated Trading Platform
Buyers



		Management Actions Overlapping	
		Yes	No
Biophysical Hotspots Overlapping	Yes	1. **Multiple outcome market – site and management actions reasonably specific**	2. **Programs/Markets with biophysical sites specified, but greater flexibility in management actions**
	No	3. **Programs/Markets with management actions specified, but greater freedom in location**	4. **Separate single outcome markets – relatively greater freedom in sites and management actions.**

Sustainable Forest Management Network
December 4, 2009

Panel 4: Perspectives on Policy Implementation in Alberta
Conservation Offsets and Tradable Disturbance Permits

Avelyn Nicol
Land Use Secretariat

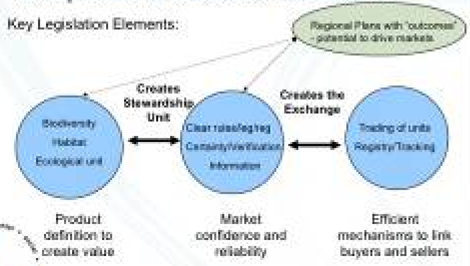
Government of Alberta

Presentation Overview

1. ALSA General Overview
2. Conservation Offsets
3. Tradable Disturbance Permits
4. Conservation Exchange
5. Green Paper for Conservation and Stewardship - policy development process with stakeholders

ALSA General Overview & Components of functional eco-markets

Key Legislation Elements:



Conservation Offsets

- Tool to counterbalance natural value/ biodiversity loss
- Applies to public/private lands
- ALSA defines activities that could qualify as offsets, including:
  - conservation and protection;
  - restoration or reclamation; and
  - creation or enhancement.

Conservation Offsets

- Activities enabled via stewardship units through the Conservation Exchange.
- Terms and conditions can be imposed regarding the type of activity to be used, and also the time period in which the stewardship unit is used.
- Monitoring and provisions for enforcement are also included in the Act.

Conservation Offsets

Some Challenges for Implementation:

- Types of offset-creating activities that are permitted.
- Geographic constraints on these activities.
- Extent of required replacement (i.e. mitigation ratios).
- Duration of offset obligation.

Tradable Disturbance Permits

- Tool for cumulative effects management on public land.
- Purpose is to minimize the overall disturbance footprint on the land.
- Permits the trading of "land disturbance" in a coordinated market.

7

Tradable Disturbance Permits

Some Challenges for Implementation:

- Overall implementation???
- Methods to measure disturbance.
- Options for grandfathering existing tenure.
- Potential options for distributing permits.
- Options for grandfathering permits.
- Alignment of a conservation offset system with a TDP program?

8

Conservation Exchange

9

Conservation Exchange

Some Challenges for Implementation:

- Refinement of primary functions/ organizational model and governance structure.
- Integration of multiple markets.
- Supply of credits prior to launching.
- Sufficient market participation – both supply and demand.
- Design of the exchange architecture.

10

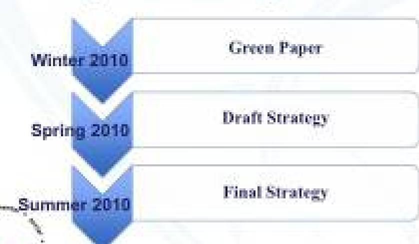
Information Systems and Requirements

Land-use Framework Strategy 6:

- Monitoring, Evaluation and Reporting Strategy.
- An information, monitoring and knowledge system.
- Will contribute to continuous improvement of land-use planning and decision making.

11

Key Consultation Stages



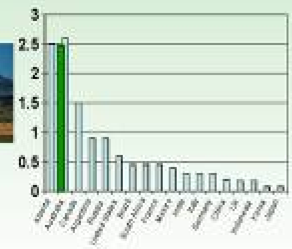
12

The Institute for Agriculture, Forestry and the Environment

Market Based Approaches to Sustaining Ecological Goods and Services on Forested Landscapes

December 04, 2009

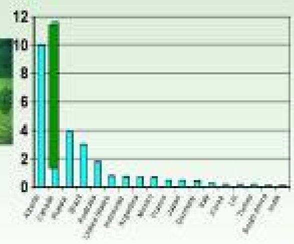
Biological Capital – Canada
(arable land per person - hectares)



+11 million hectares – pasture and forage

Government of Alberta

Biological Capital – Canada
(forest area per person - hectares)



Government of Alberta

Alberta Farm Gate Value (2008)

Product	Value ($mil)
Beef	3,104
Canola	1,216
Wheat	1,251
Hogs	465
Dairy	426
Poultry	225
Pulses	121
Barley	282
Potatoes	148
Vegetables	82

Alberta Forest Industry

- 35 million hectares of forest
- Est. annual fibre growth – 45m m^3
- Lumber, pulp/paper, panel board
- $8.4 billion (primary forest products)
- $2.3 billion (secondary forest products)
- 54,000 jobs

Premier's Mandate

IAFE to be a catalyst to:

- Improve environmental outcomes
- Enhance competitiveness opportunities for Agriculture and Forestry
- Brand Alberta as the leader in Environmental Innovation.

Through:

- ***Market-Based Instruments for Ecosystem Services***
- ***Documenting Environmental Integrity***
- ***Innovation***
- ***Conservation and Stewardship Strategy***

IAFE

Three core strategies

- **Expert Advice - Information gathered from various work done by government, academics, ENGOs, and industry.**
  - e.g.

- **Engagement - Ongoing and comprehensive dialogue with the Government of Albert.**
- **Integration - Alignment with other GOA policies and processes.**

IAFE

Forestry in Alberta

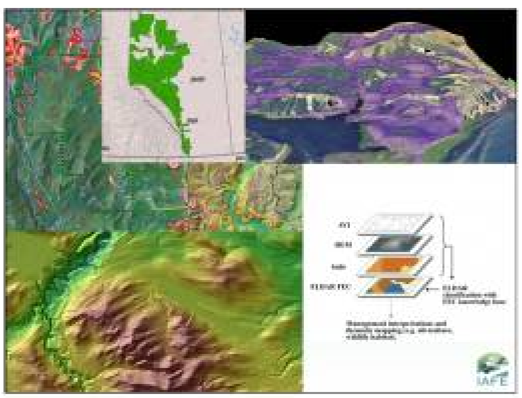
IAFE

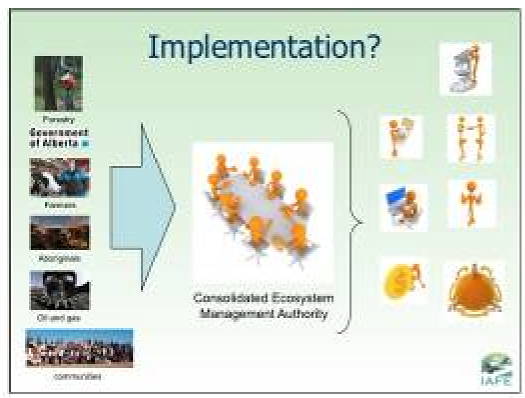
Forest Management Involves

IAFE

Forest Business Model

IAFE





The Need for an Ecosystem Services Market Policy Framework

- The Land-use Framework (LuF) and the Alberta Land Stewardship Act have changed the landscape.
- LuF and IAFE are complementary processes.
  - LuF will define outcomes and specific tools to meet outcomes.
  - IAFE focuses on broader policy shift to market-based approach.
- The Ecosystem Services (ES) Market Policy Framework will allow businesses to use natural assets or ES as a new profit centre, with opportunities for revenue generated through the market, providing options through which to achieve the LuF outcomes and objectives identified.

Ecological Assessment Of Offsets

Jim Schieck

December 4, 2009

What I Will Discuss

Using Science to Assess Offsets

1) Creating an Integrated Ecological Measure
2) Assessing Ecological Condition at Sites
3) Determining Offset Rations
   a) Incorporating differences between disturbed and conserved sites
   b) Incorporating differences among habitat types
   c) Incorporating differences among locations
4) Evaluating Success at the Regional Level

Stuart Whitten, CSIRO

Measuring Offset Condition

Strict like for like (local – same for same)	Habitat A (damage site) ≡ Habitat B (offset)
Quality adjusted like for like (local – condition/security)	$H_a = H_b$ (quality/security adjusted)
Functional equivalence (Can include indirect offsets)	$H_a = H_b = f(X_1, X_2, X_3, \ldots, X_n)$
At least – metric based (simplifies measure and method where few trades likely)	$H_a < H_b$
At least – expert opinion based (offset is greater than damage)	Evaluation panel opinion is that $H_a < H_B$

Ecosystem Services

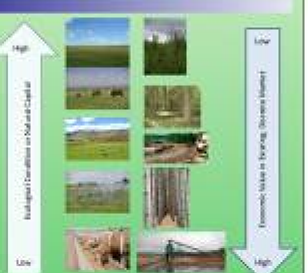
Ecosystem services = Benefits people obtai[n] from ecosystems

From: Millennium Ecosystem Assessment

Ecosystem Services – One Measure

Increasing site condition enhances all ecological services including:

It is possible to develop a single market for ecological services.



Measuring Site Condition (History)

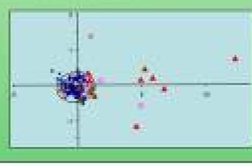
Integrated Measure of Ecological or Biodiversity Condition
→ used extensively for EIA's

Index of Biotic Integrity (IBI; Karr 1981)
→ evaluates biota at a test site in relation to biota at "pristine" sites
→ if biota are similar to "pristine" then site is healthy
→ combines info on abundance of indicator taxa
→ uses an additive model # invaders + # predators - # grazers
→ models developed by analyses and expert opinion
→ extended to plants, birds & mammals

Measuring Site Condition (cont.)

Reference Condition Approach (RCA; Bailey et al. ~1995)

→ developed for aquatic inverts, but applicable to all taxa
→ more objective comparison between test and "pristine" sites
→ uses all species in the analyses
→ identifies natural variation when determining "pristine" conditions
→ relationships calculated using ordinations



Measuring Site Condition (cont.)

Intactness of Species Communities (ABMI)

→ based on maximum likelihood methods
→ identifies signal better than ordination
→ deviance determined for each species at the "test" site and then averaged across species
→ deviance converted to a measure from 0 (similar to the mean of undisturbed) to 100 (totally altered)
→ can be done for any individual taxa, or all taxa combined
→ still under development

What Biota To Include

ABMI Solution

Emphasis on "species assemblages"

– with > 2000 species surveyed expect that some will respond to each type of ecological change

Vascular Plants
Mosses
Lichens
Birds
Mammals
Fish

Springtails
Mites
Aquatic Invertebrates

Assemblages chosen based on ease of sampling, statistical properties, and importance to society

Determining Offset Ratios

Simplest implementation is to assume a 1:1 relationship (1 ha developed replaced by 1 unit conserved)

However → different locations are never "ecologically equal"

– Therefore ecosystem condition needs to be evaluated in both the developed and conserved locations

– Two scales are important

– site-level trade-off

– regional ecological consequence

Outline (from above)

Using Science to Implement Market Based Instruments

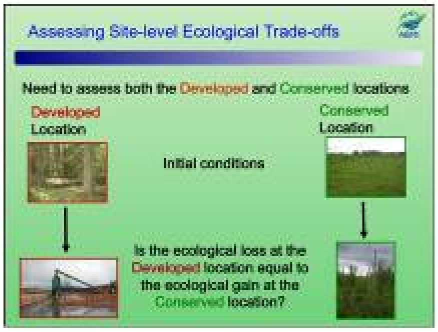
1) Combining Ecological Services

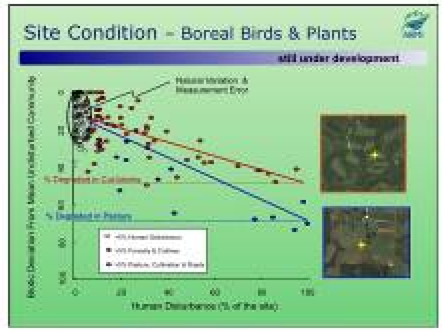
2) Assessing Ecological Condition at Sites

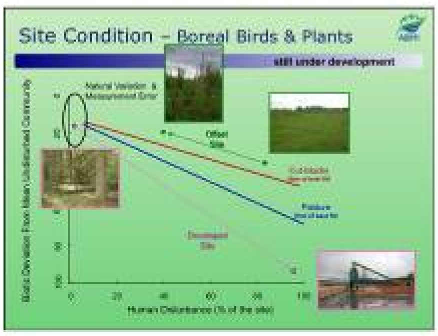
3) Determining Offset Rations

a) Incorporating differences between disturbed and conserved sites
b) Incorporating differences among habitat types
c) Incorporating differences among locations

4) Evaluating Success at the Regional Level


Assessing Site-level Ecological Trade-offs
Need to assess both the Developed and Conserved locations
Developed
Location
Conserved
Location
Initial conditions
Is the ecological loss at the Developed location equal to the ecological gain at the Conserved location?


Site Condition – Boreal Birds & Plants
still under development
Natural Variation &
Measurement Error
Human Disturbance (% of the site)


Site Condition – Boreal Birds & Plants
still under development
Natural Variation &
Measurement Error
Offset
Site
Developed
Site
Human Disturbance (% of the site)


Outline
Using Science to Implement Market Based Instruments
1) Combining Ecological Services
2) Assessing Ecological Condition at Sites
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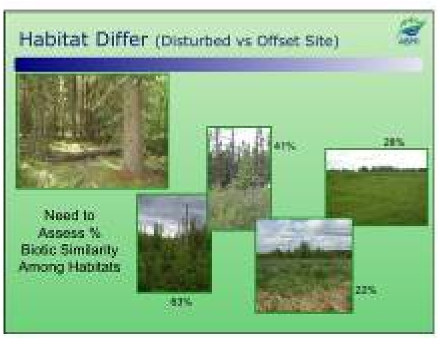
Habitat Differ (Disturbed vs Offset Site)
Need to
Assess %
Biotic Similarity
Among Habitats
41%
28%
22%
83%


Outline
Using Science to Implement Market Based Instruments
1) Combining Ecological Services
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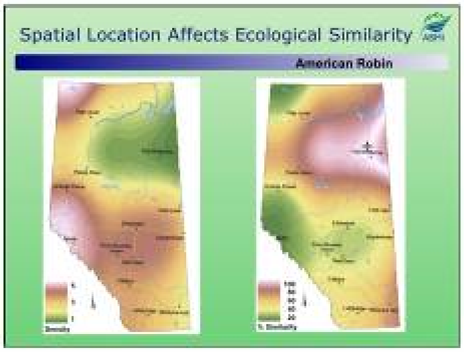
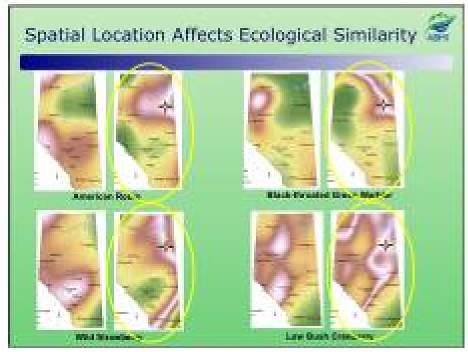
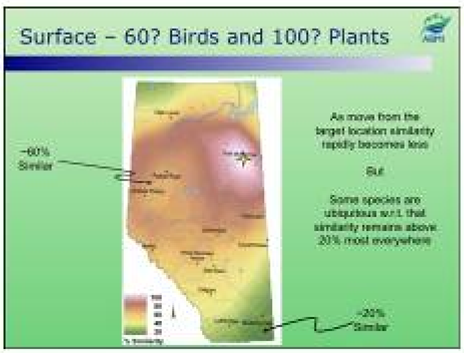
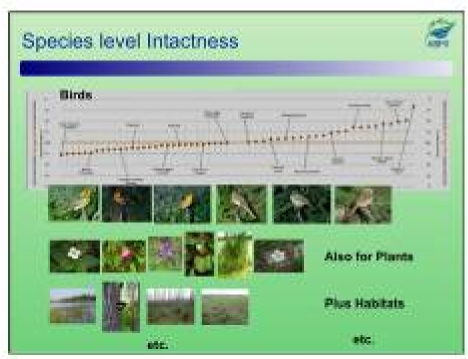

Spatial Location Affects Ecological Similarity
American Robin


Spatial Location Affects Ecological Similarity


Surface – 60? Birds and 100? Plants
~60% Similar
As move from the target location similarity rapidly becomes less
But
Some species are ubiquitous w.r.t. that similarity remains above 20% most everywhere
~20% Similar


Cumulative Effects
Site-level Offsets Overlook Cumulative Effects


Regional-level Ecosystem Health
More than 40 commitments by the Alberta provincial government
All of the commitments are at the Regional Level (sustainable management)
ABMI Tracks Regional Health (Intactness) at the Regional Scale
Average of Ecosystem Health from at all sites within the region
• 1656 sites
• grid pattern
• 20 km spacing

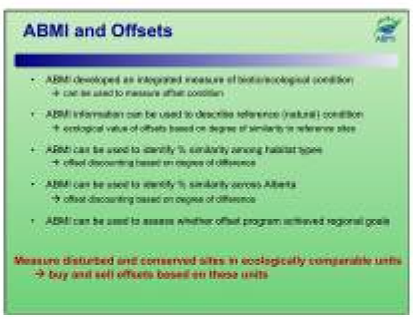

Species level Intactness
Birds
Also for Plants
Plus Habitats
etc.
etc.

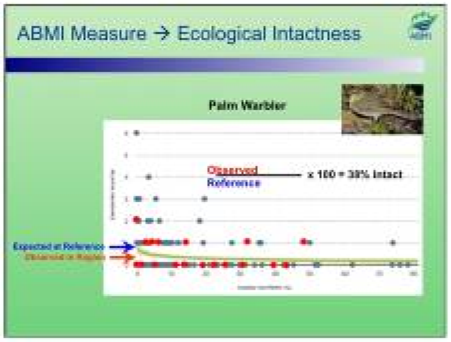

Biotic level Intactness
Average Regional Health
in
NE Alberta
Average of
64-67%
Depending on
Group Assessed


Fast Assessment (extra complication)
Vascular Plants
Mosses
Lichens
Birds
Mammals
Fish
Springtails
Mites
Aquatic
Invertebrates
Precise Measures of Many Different Taxa
(expensive to measure)
Few Simple Measures
(2-4 hours to measure
at a location)


Fast Assessment
1) Research to identify
confidence in
reduced suite
of measures
2) Research to understand
how changes affect
ecological condition
3) Long-term sampling at
a few locations to verify
relationships continue to hold


Summary
• Offset ratios can determined arbitrarily (eg. 1:1)
– Not objective
• Offset ratios can be determined rigorously
– Ecological services can be assessed as a single metric of ecological condition (biotic/ecosystem integrity)
– Ratios of ecological condition in disturbed and conserved areas can be evaluated
– Differences in biotic communities among habitat types can be incorporated
– Differences in biotic communities among geographic areas can be incorporated
– Expected positive effects of habitat enhancement can be described rigorously
– Quick site-level assessment of ecological condition can be developed
• To assess whether offsets are effective, regional cumulative assessment is required


ABMI and Offsets
• ABMI developed an integrated measure of biotic/ecological condition
→ can be used to measure offset condition
• ABMI information can be used to describe reference (natural) condition
→ ecological value of offsets based on degree of similarity to reference sites
• ABMI can be used to identify % similarity among habitat types
→ offset discounting based on degree of difference
• ABMI can be used to identify % similarity across Alberta
→ offset discounting based on degree of difference
• ABMI can be used to assess whether offset program achieved regional goals
Measure disturbed and conserved sites in ecologically comparable units
→ buy and sell offsets based on these units


ABMI Measure → Ecological Intactness
Palm Warbler
Observed
Reference
x 100 = 39% Intact
Expected at Reference


Converting Data to Ecosystem Health
Landscapes
Habitats
Species

Workshop Participants

Name	Affiliation
Vic Adamowicz	University of Alberta
Jay Anderson	University of Alberta
Amy Ando	University of Illinois
Mike Armeneau	MEG Energy Corp.
Neil Barker	Alberta Sustainable Resource Development
Tricia Bell	Alberta Environment
Alison Boddy	Sustainable Forest Management Network
Vicky Bossé	Alberta Sustainable Resource Development
Peter Boxall	University of Alberta
Geneva Claesson	Deloitte and Touche LLP
Shari Clare	University of Alberta
Robert Deal	US Forest Service
Craig Denisoff	Westervelt Ecological Services
Yulian Ding	University of Alberta
Ron Dunnigan	Alberta Sustainable Resource Development
Dan Farr	University of Alberta
Gordon Giles	Alberta Sustainable Resource Development
Laura Graham	Alberta Tourism, Parks and Recreation
Rifaat Hammad	Alberta Environment
Jim Herbers	Alberta Biodiversity Monitoring Institute
Candice Hergot	Alberta Energy
Anne Huennemeyer	Alberta Research Council
Joey Hurley	Alberta Agriculture and Rural Development
Cynthia Kaufmann	Sustainable Forest Management Network
Steve Kennett	Independent Consultant
John Kerkhoven	Suncor Energy
Russell Krauss	Resource Environmental Solutions, LLC
Gord Lehn	Spray Lake Sawmills
Nathan Lemphers	The Pembina Institute
Bruce Macnab	Sustainable Forest Management Network
Keith McClain	Alberta Sustainable Resource Development
Hon. Ted Morton	Minister, Alberta Sustainable Resource Development
Veronika Nemes	Victoria Department of Sustainability and the Environment
Avelyn Nicol	Alberta Land-use Secretariat
Steve Price	Institute for Agriculture, Forestry and the Environment
Jason Proche	Deloitte and Touche LLP
Matthew Pyper	Sustainable Forest Management Network
Kendra Ramdanny	Canadian Boreal Initiative
Jeff Reynolds	Alberta Sustainable Resource Development

Philippa Rodrigues	Alberta Sustainable Resource Development
Jim Schieck	Alberta Biodiversity Monitoring Institute
Rick Schneider	University of Alberta
Sherry Sian	Canadian Association of Petroleum Producers
Stephanie Simpson	University of Alberta
Larry Simpson	The Nature Conservancy of Canada
Catalina Solano-Rivera	Sustainable Forest Management Network
John Stadt	Alberta Sustainable Resource Development
Nicole Strang	Alberta Agriculture and Rural Development
Darren Tapp	Alberta Sustainable Resource Development
Rory Thompson	Alberta Sustainable Resource Development
Mike Voisin	Alberta-Pacific Forest Industries
Marian Weber	University of Alberta, Alberta Research Council
Barry White	Alberta Sustainable Resource Development
Stuart Whitten	Commonwealth Scientific and Industrial Research Org.
Elizabeth Wilman	University of Calgary
Todd Zimmerling	Alberta Conservation Association