Confronting Climate Change Through Restoration Initiatives Of the Department of the Interior's NRDAR Program

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Natural Resource Damage Assessment

Restore natural resources injured by an oil spill or release of a hazardous substance.

Damage assessments provide the basis for determining restoration needs that address the public's loss and use of these resources.

Glomb and Kennedy 2011

The Natural Resource Damage Assessment Process

Assessment:

- **Injury Determination**
- **Injury Quantification**

Damage Calculation

Restoration Options

Settlement or Litigation

Restoration Implementation

Restoration Monitoring

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NRDA and restoration

Pellston workshop on global climate change and contaminant assessments

Climate change effects on NRDA process and on restoration – adaptation and mitigation

Federal energy use and mandates

Carbon sequestration on NRDA restorations

Carbon sequestration as value-added

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Influence of Global Climate Change on the Scientific Foundations and Applications of Environmental Toxicology and Chemistry

A SETAC International Pellston Workshop

We sought to answer the question:

How will global climate change influence

1) the environmental impacts of chemicals and

2) the way we assess and manage chemical impacts in the environment?

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Influence of Global Climate Change on the Scientific Foundations and Applications of Environmental Toxicology and Chemistry

A SETAC International Pellston Workshop

Through publications, workgroups reviewed and developed research needs for:

Chemical Occurrence, Fate and Availability

Toxicological Mechanisms

Ecological Effects at Scales from Population to Landscape

Human Health Risk Assessment

Ecological Risk Assessment

Damage Assessment and Restoration Ecology

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Climate Change and Injury/Damage Assessments

GCC will: Influence exposure and effects inputs into NRDAs
Act as a co-occurring stressor with chemical/oil impacts

Challenge: Incorporate both influences on injury and service loss into Natural Resource Damage Assessments

Injury is quantified against baseline conditions, considering the pre-injury conditions of the resource, pre-existing anthropogenic modification

GCC will complicate development of Baseline Conditions

Challenge: Develop temporal and spatial baselines accounting for the progression of GCC effects both historical and in the future, in the absence of contaminant injury.

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Climate Change and Ecological Restoration

Challenges

Shifting species ranges and assemblages (including migratory pathways and timing)

Invasive species occurrence and prevalence

Changing temperatures and precipitation patterns and the resulting changes in surface hydrodynamics

Balancing sea level rises and saltwater intrusion with increasing erosion and sediment deposition in shoreline restorations

Implications

Restoring ecosystem structure, function, and services may preclude the ability to completely restore pre-injury species assemblages

Forecasting the whereabouts of replacements to be acquired or upgraded may become a challenge.

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Climate Change and Ecological Restoration

Carefully designed NRDA-associated restorations can provide both Adaptation and Mitigation opportunities

Adaptation to Climate Change Effects through Ecological Restoration

Develop diverse restored ecosystems with functional redundancy to provide resilience necessary to buffer both short- and long-term effects of climate change

Provide habitat, refugia, and corridors for species impacted by GCC-induced stressors

Seek opportunities to provide habitat for threatened or endangered species previously extirpated from restored areas

Strengthen shorelines and offshore barriers with oyster and seagrass beds, mangroves, and other transitional ecosystems to protect on-shore habitats from increasingly intense storm events

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Climate Change and Ecological Restoration

Adapt to species loss, ice sheet disintegration, increased intensity of floods, storms, droughts and fires? Such talk is disingenuous and futile. For the sake of justice and equity, for our children, grandchildren and nature we have no choice but to focus on mitigation.

James Hansen

Mitigation Measures in Ecological Restorations

Revegetation, afforestation, & reforestation to maximize carbon sequestration – both immediate and long term

Soil amendment and management practices to increase carbon sequestration in the soil environment

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The White House October 5, 2009

Executive Order 13514

FEDERAL LEADERSHIP IN ENVIRONMENTAL, ENERGY, AND ECONOMIC PERFORMANCE

Section 1. Policy. In order to create a clean energy economy that will increase our Nation's prosperity, promote energy security, protect the interests of taxpayers, and safeguard the health of our environment, *the Federal Government must lead by example*.

Section 9(a)iii. Recommendations for Greenhouse Gas Accounting and Reporting. "...<federal agencies including> the Department of the Interior... shall... develop and provide...greenhouse gas reporting and accounting procedures... that:

...consider and account for sequestration and emissions of greenhouse gases resulting from Federal land management practices;.."

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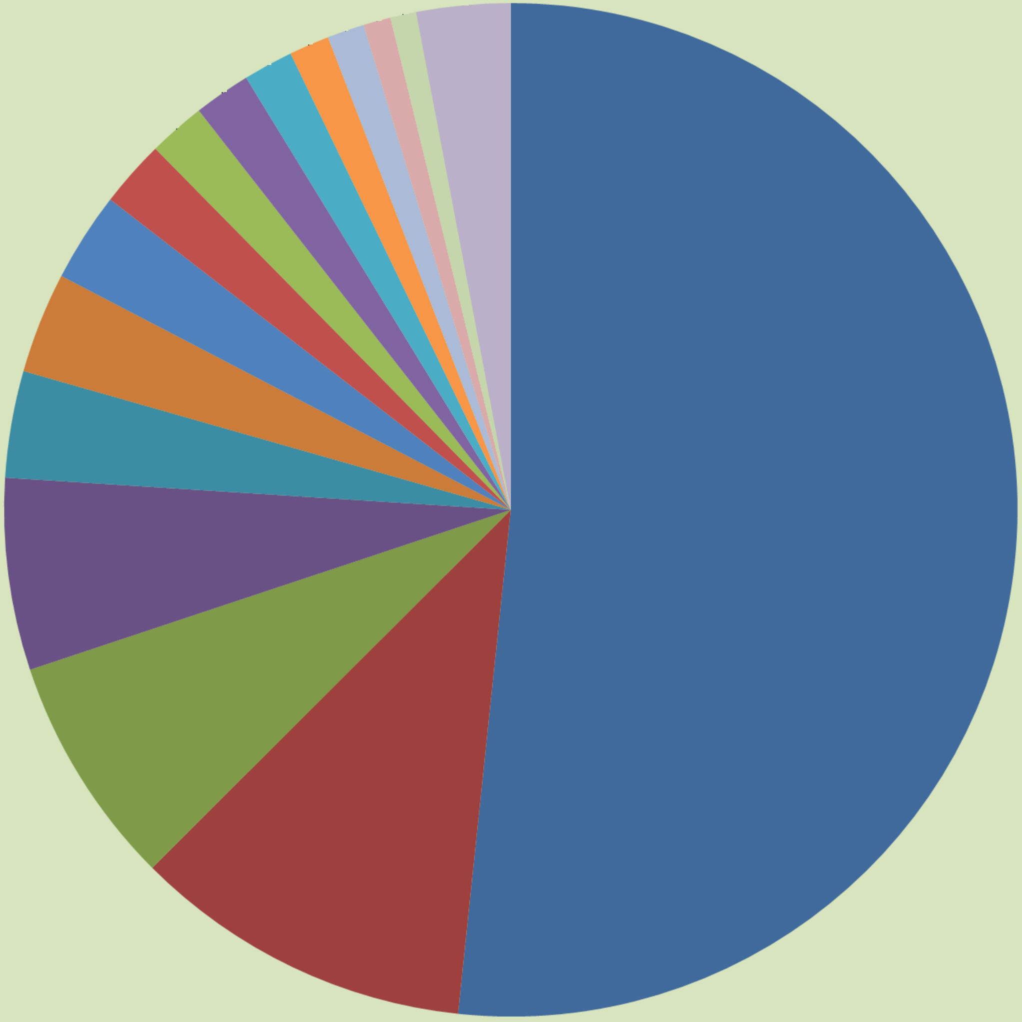
US Federal Government FY2010 GHG Inventory of Emissions Covered by Reduction Targets



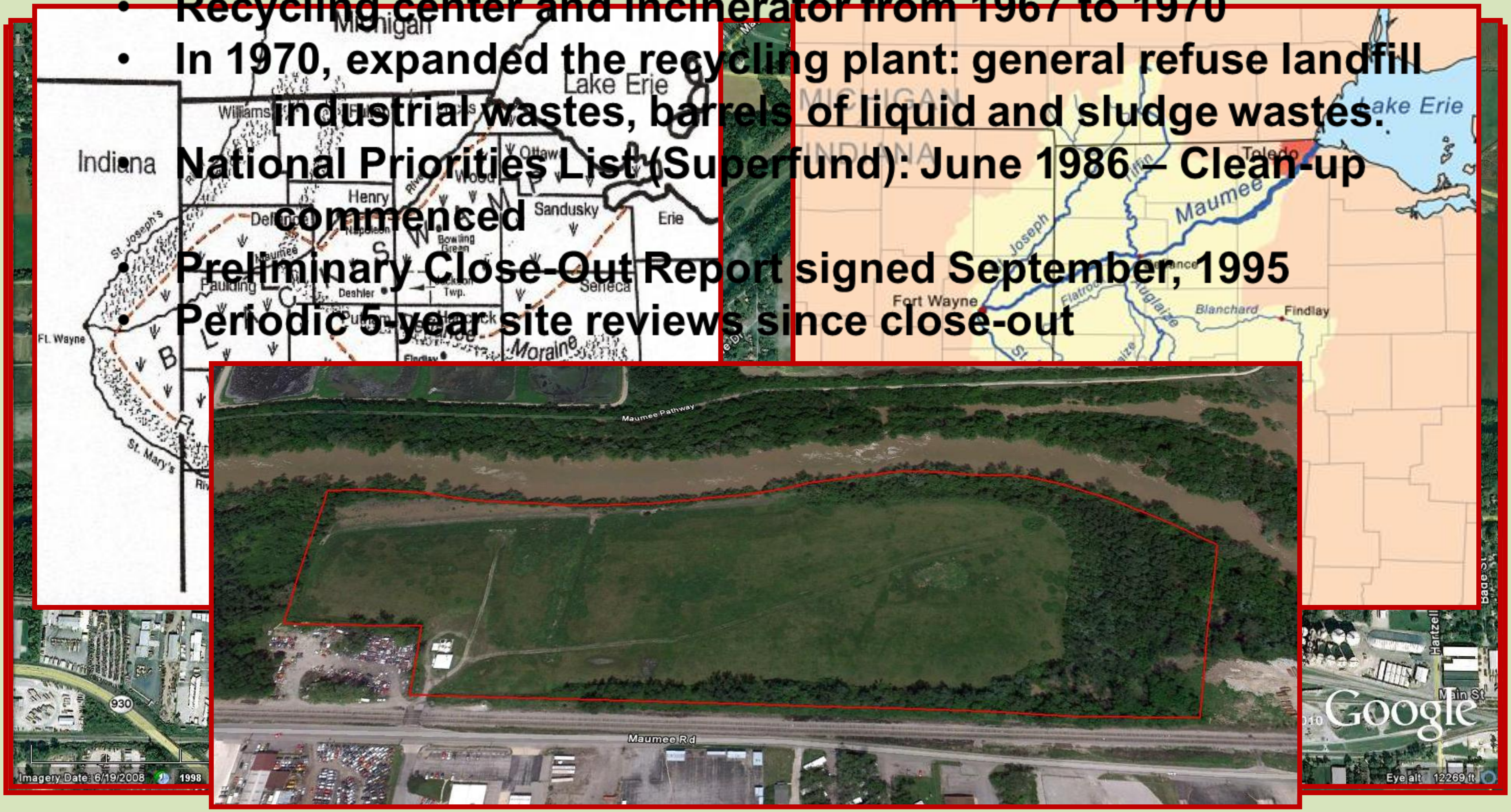
Two examples of carbon sequestration assessments in NRDA restoration activities:

The Fort Wayne Reduction Works site and the Maumee River restoration – A retrospective analysis

Southern Missouri mining regions – Incorporating carbon sequestration into restoration planning

Fort Wayne Reduction Works and The Maumee River Restoration

- Recycling center and incinerator from 1967 to 1970
- In 1970, expanded the recycling plant: general refuse landfill industrial wastes, barrels of liquid and sludge wastes.
- National Priorities List (Superfund): June 1986 – Clean-up commenced
- Preliminary Close-Out Report signed September, 1995
- Periodic 5-year site reviews since close-out



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The Maumee River Riparian Restoration

Year Planted	2000	2008
Acres Planted	~47	~13
Species		
Bur Oak (*Quercus macrocarpa*)	3000	800
Pin Oak (*Q. palustris*)	2500	500
Swamp White Oak (*Q. bicolor*)	1500	0
Swamp Chestnut Oak (*Q. michauxii*)	1500	0
Green Ash (*Fraxinus pennsylvanica*)	3500	0
Sycamore (*Platanus occidentalis*)	3500	600
River Birch (*Betula nigra*)	1000	700
Shellbark Hickory (*Carya laciniosa*)	1000	700
Overcup Oak (*Q. lyrata*)	1000	400
Silky Dogwood (*Cornus amomum*)	1700	0
Red Osier Dogwood (*C. sericea*)	1600	0
Buttonbush (*Cephalanthus occidentalis*)	1600	500
Tulip (*Liriodendron tulipifera*)	0	500
Black Walnut (*Juglans nigra*)	0	500
Total Seedlings Planted	25400	5200
Seedlings Planted/Acre	540	400

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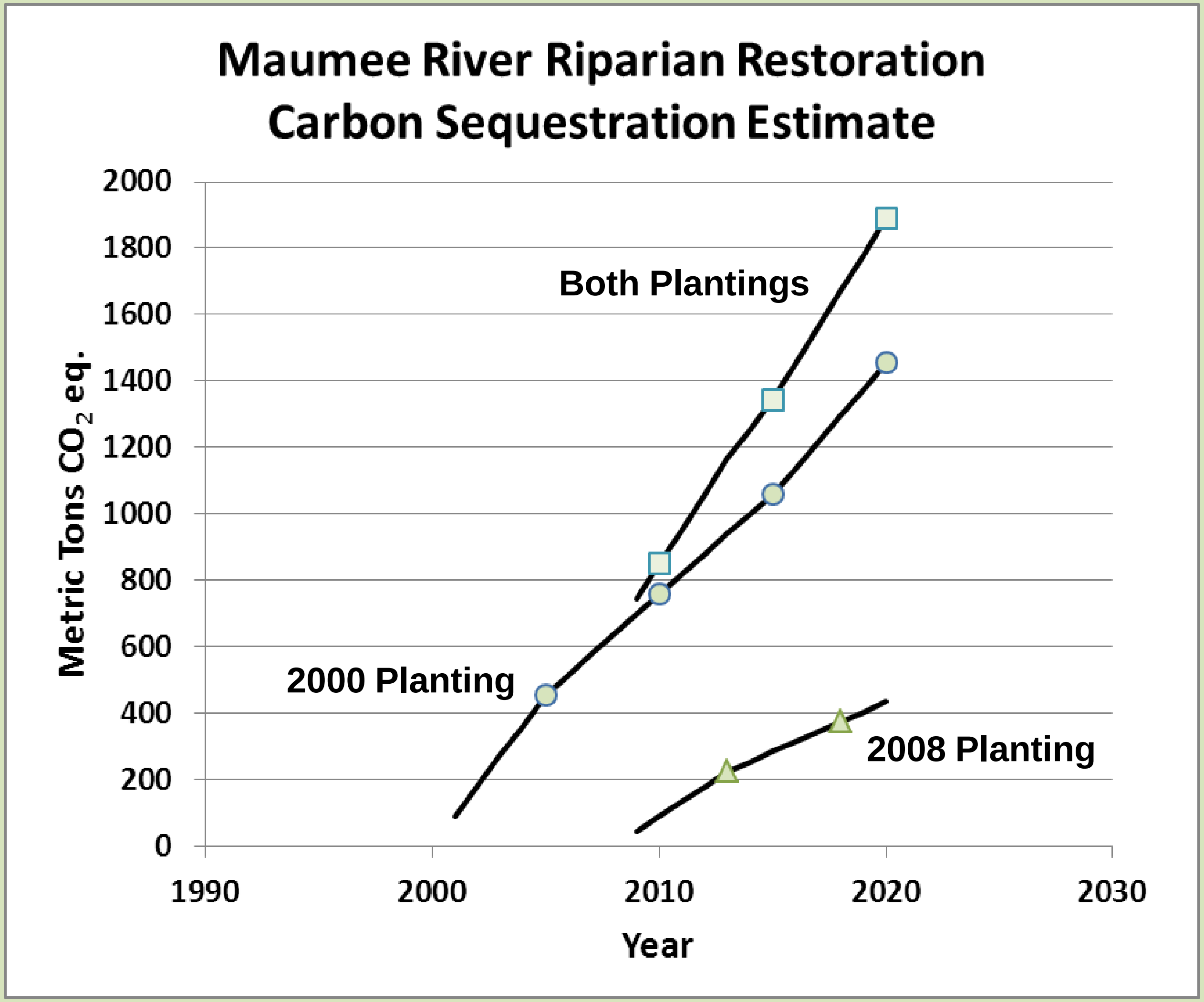

USEPA Reforestation Afforestation Project Carbon On-Line Estimator
http://ecoserver.env.duke.edu/RAPCOEv1/ProjectSettings.aspx

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Past and Present Lead Mining in Missouri

Biosolid amendments to chat residues and mine tailings

Carbon Sequestration as Value Added In NRDA Restorations

Loss of carbon sequestration capacity of damaged resources is not included in NRDAs of contaminated sites – *it is not an injury*

Therefore, carbon sequestration that is gained with restoration cannot be used to fulfill a responsible party's restoration obligation.

Once quantified, however, it could be valued by the market (e.g. restoration banking or carbon markets).

Carbon sequestration on NRDA restorations could increased value of restoration to the public and responsible party

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Carbon Sequestration as Value Added In NRDA Restorations
An Example

To compensate for a contaminated riverside waste site, a responsible party (RP) agrees to restore 100 acres of abandoned farmland back to riparian hardwood forest.

This activity, along with long-term site monitoring and stewardship, fulfills the obligations of the legally agreed-upon settlement.

A detailed C sequestration assessment performed.

Carbon credits obtained through the restoration can then join the carbon market and be sold or traded under the market guidelines for such activities.

Who gets the credit? RP, NGO, Local Entities...

Bottom line: A win-win opportunity

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