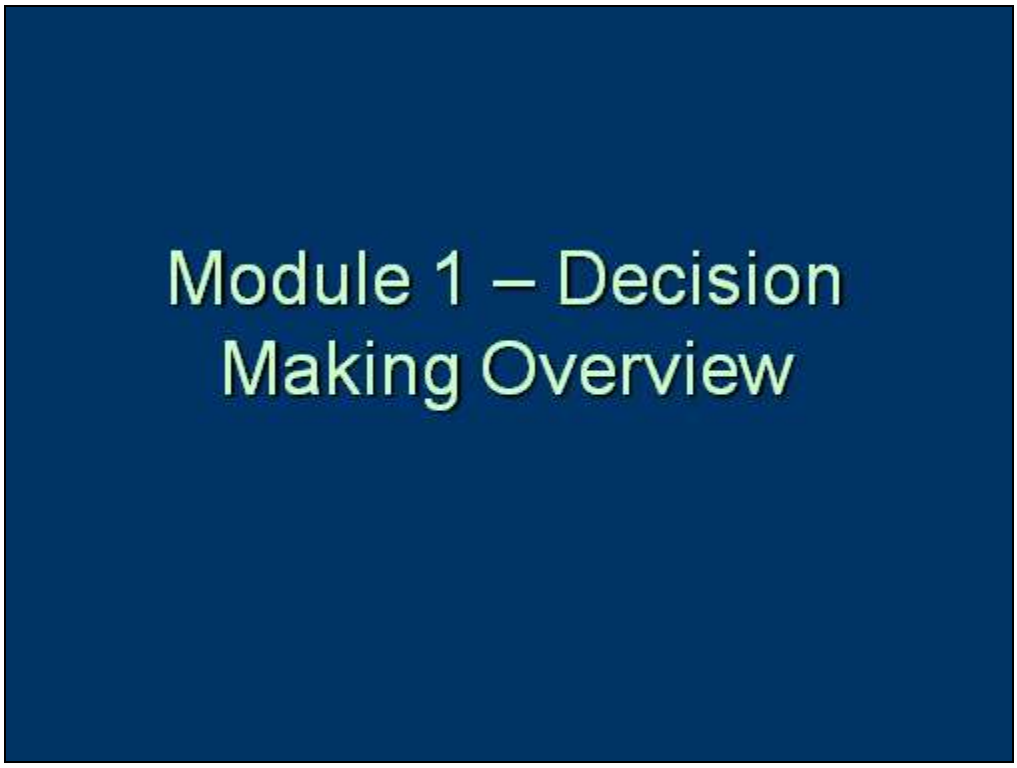


Module 1: Decision Making Overview

This Module will provide an overview of the decision making process.

Decision Making Definitions

We make decisions every day. Some decisions are relatively straightforward and simple: Should I put fertilizer on my lawn? Others are quite complex: How can our community maintain a balance between industrial and residential areas while protecting human health, providing access to jobs, and making this a place where people want to live?

Simple decisions usually need a simple decision-making process. Complex decisions, however, require a more complicated process because they typically involve issues like:

Uncertainty – a limit to knowledge where it is impossible to describe an existing state or future outcome accurately

Multiple Options with Trade-offs – a consideration of many possible solutions where changing one factor in a positive way could negatively affect others

Value Conflicts – a difference of opinions based on differing concepts of good and bad or right and wrong

Extended Time Horizons – a situation where the impact of a decision today does not materialize for many years

Organizational and Institutional Constraints – factors (such as legislative authority and resource limitations) that limit effective implementation of decisions

High Stakes - a risky situation in which somebody is likely to win or lose a great deal

To review an example of a complex decision, see the *Portland example (Appendix A)*.

Decision-Making – Who are the Decision-Makers?

Sometimes it is difficult to identify who the decision makers actually are. Here is a short list of decision-makers for land and resource use decisions.

Policy-makers develop and enact laws and regulations for federal, state, and local jurisdictions.

Environmental managers and natural resource managers at the regional and state* scale determine how to implement existing laws and regulations.

City and county governments, planning commissions, and similar entities determine local land usage within the constraints of laws and regulations.

Individuals representing themselves or their businesses perform daily activities that affect the environment. Some typical decisions may be:

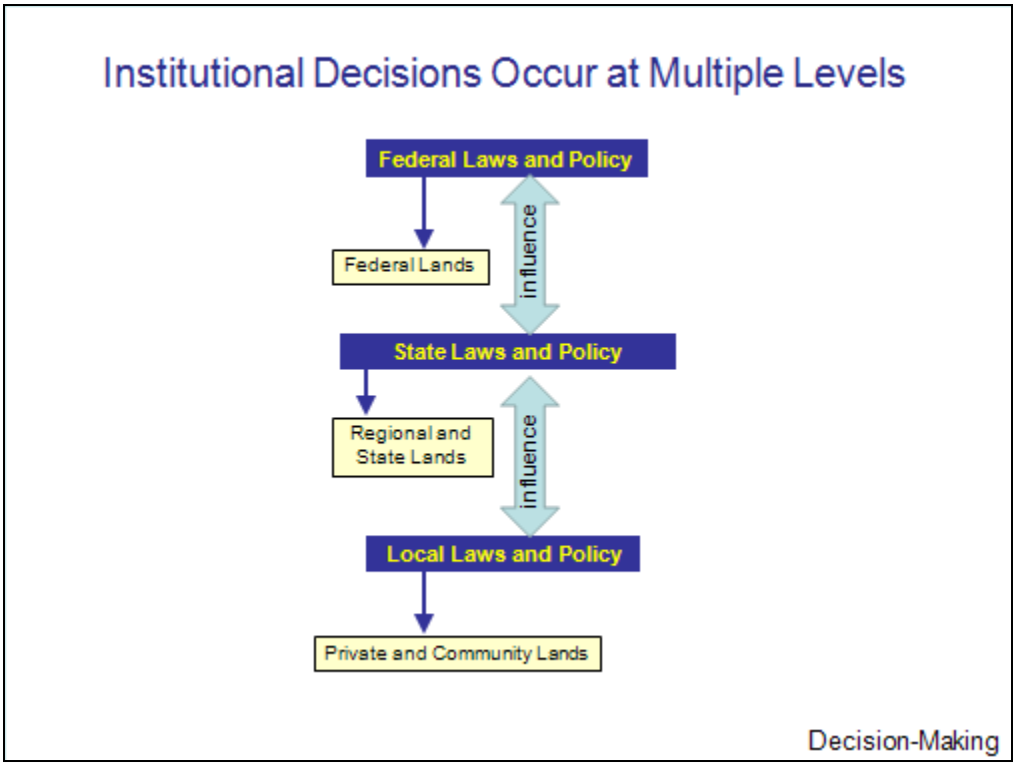
Should I add fertilizer, herbicides, or pesticides to my lawn?

Should I consider a pervious surface for my parking lot to decrease stormwater runoff?

Should I allow my cattle to enter the creek on my farm?

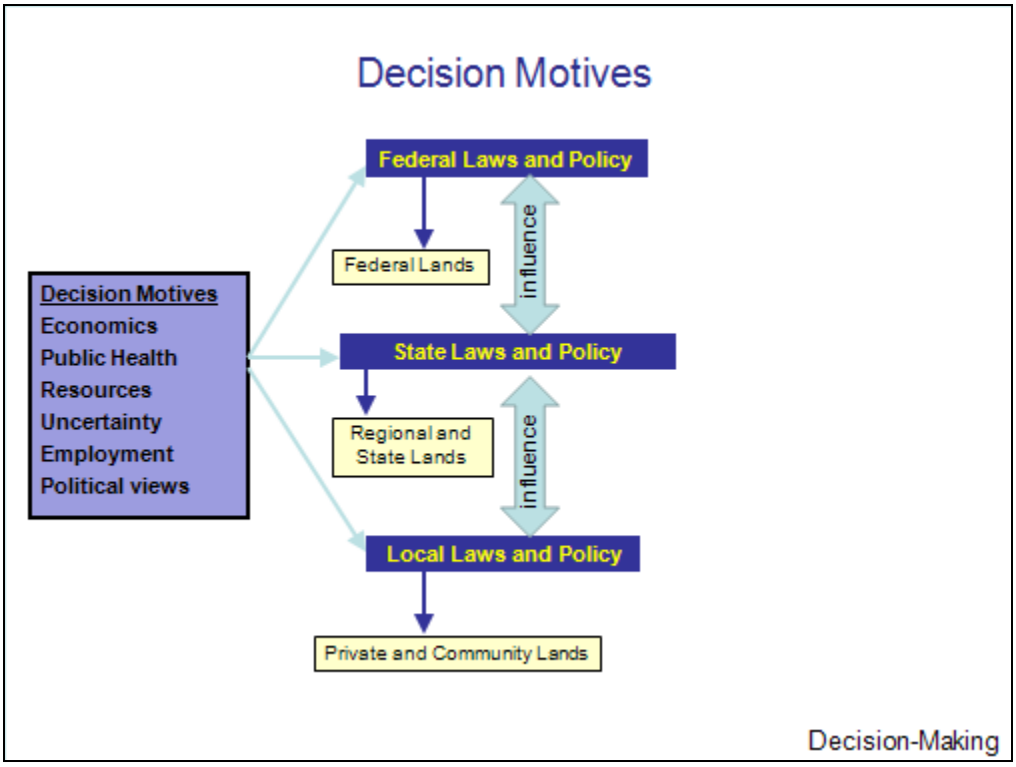
Sometimes, seemingly innocuous decisions can affect areas beyond the decision location. In the above examples, all of the decisions will affect anyone who is "downstream".

* When the term "state" is used throughout the course it is intended to represent any U.S. jurisdiction, which includes states, territories, tribes and commonwealths.



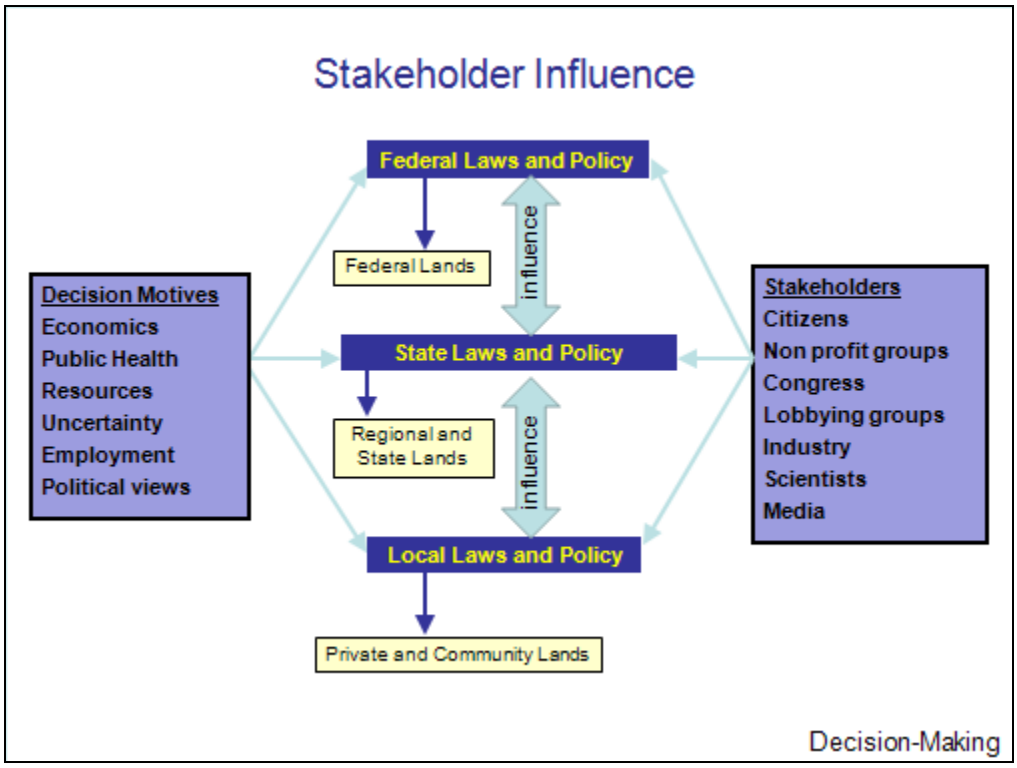
Decision-Making – Institutional Decisions Occur at Multiple Levels

Institutional (government) decisions are made at three principal levels; federal (e.g., the Clean Water Act), regional and state (e.g., watershed management, State wilderness preserves), and local (e.g. land development permits). Laws and policies made at any level influence laws and policies at other levels. Laws and policies can also affect land and other environmental resources at multiple levels. Unfortunately, groups and individuals in these institutions sometimes make decisions with little knowledge or consideration of decisions being made at other levels. Improved decision-making includes awareness of the cumulative (and incremental) impacts of multiple local decisions (bottom-up) as well as the local consequences of regional and national environmental policy (top-down).



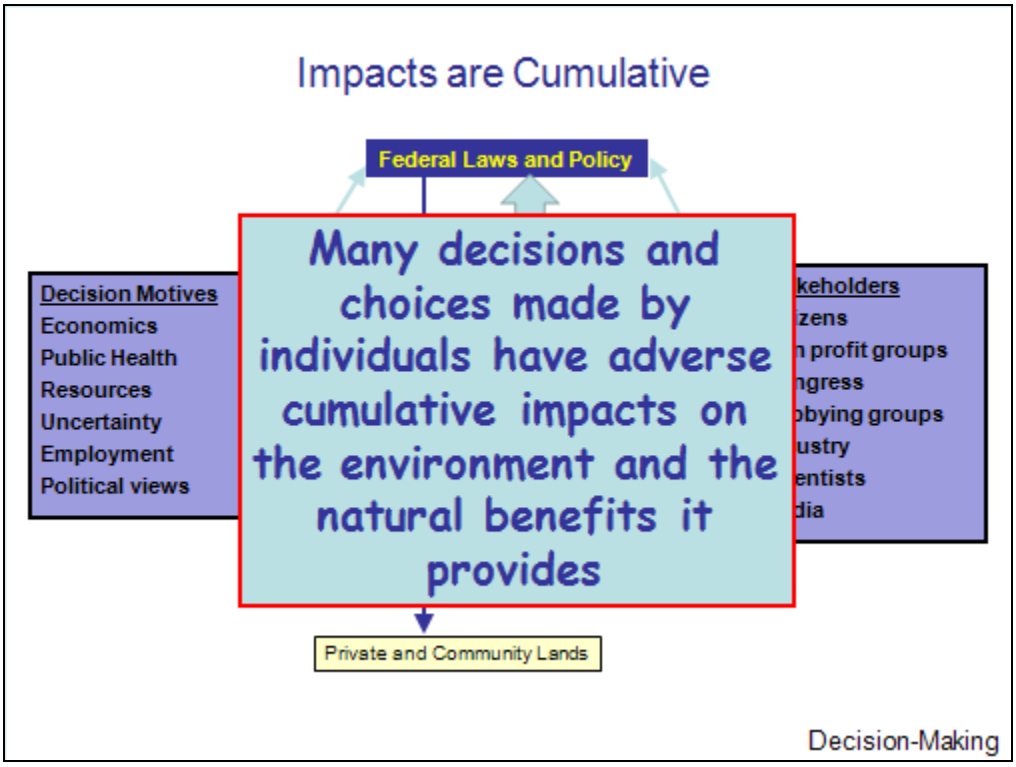
Decision-Making – Decision Motives

Different motives can influence decisions. These might include economic viability, public health, resource limitations, lack of knowledge (uncertainty), rates of employment, or political gain. Sometimes motives can be short-term in nature and may not consider sustainability, the capacity of the earth to give us water, food, and fiber into the future.



Decision-Making – Stakeholder Influence

Different groups of stakeholders can also influence decisions. Among these are citizens likely to be affected by a decision, non-profit organizations, Congressional representatives, lobbying groups, industrial groups, scientists or academia, and the media. Different needs or desires motivate each of these groups.

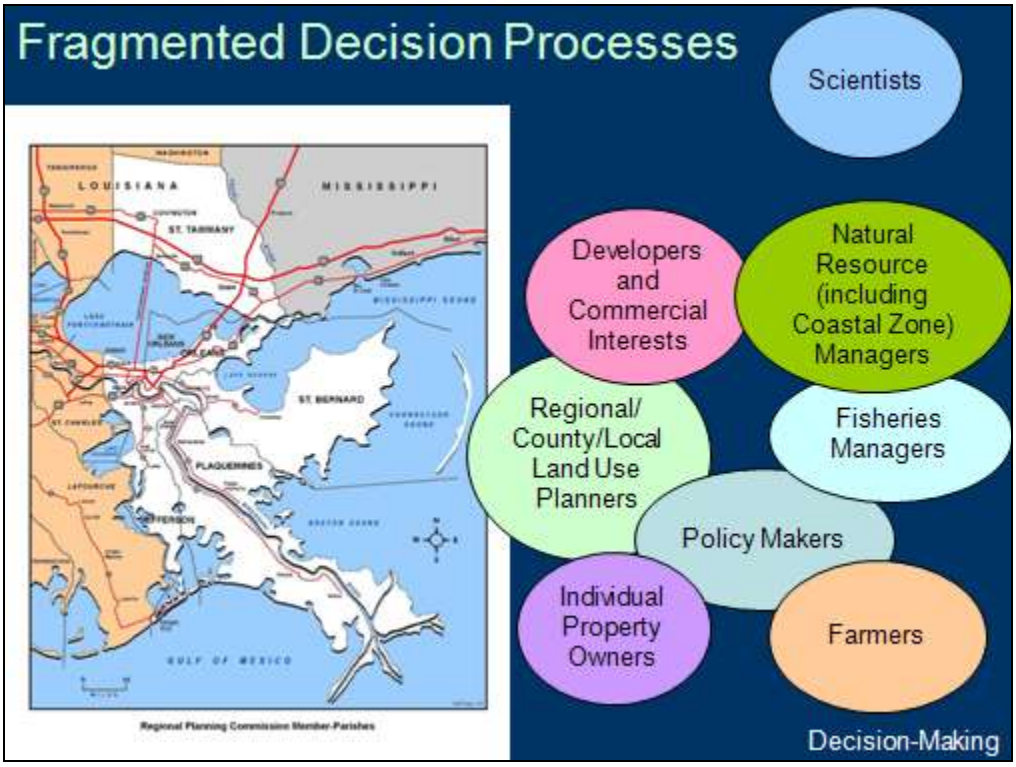


Decision-Making – Impacts are Cumulative

Many effects on the environment are the cumulative result of individual decisions and actions.

Purchases of food, energy, material goods, automobiles, homes – anything we buy – represent a decision to use something from the environment, directly or indirectly, for our personal use. Although it may seem that individual decisions cannot have a major environmental impact, the cumulative effect of hundreds or thousands of individuals making a decision (say, to fertilize their lawns) can have an enormous adverse effect on environmental condition and the delivery of ecosystem goods and services.

In sum, decision-making needs to occur in a systems-oriented manner. Decision-makers need to consider different scales, stakeholder groups, and systems-level effects in their decision process. Otherwise, the decision process can become quite fragmented.



Decision-Making – Fragmented Decision Processes

Land and resource use decision-makers tend to operate within their professional and personal spheres. These spheres may overlap somewhat, but are not consistently integrated. Each sphere has its own laws, regulations, policies, legal jurisdiction and mandate, all of which unfortunately lead to a fragmented decision process.

For example:

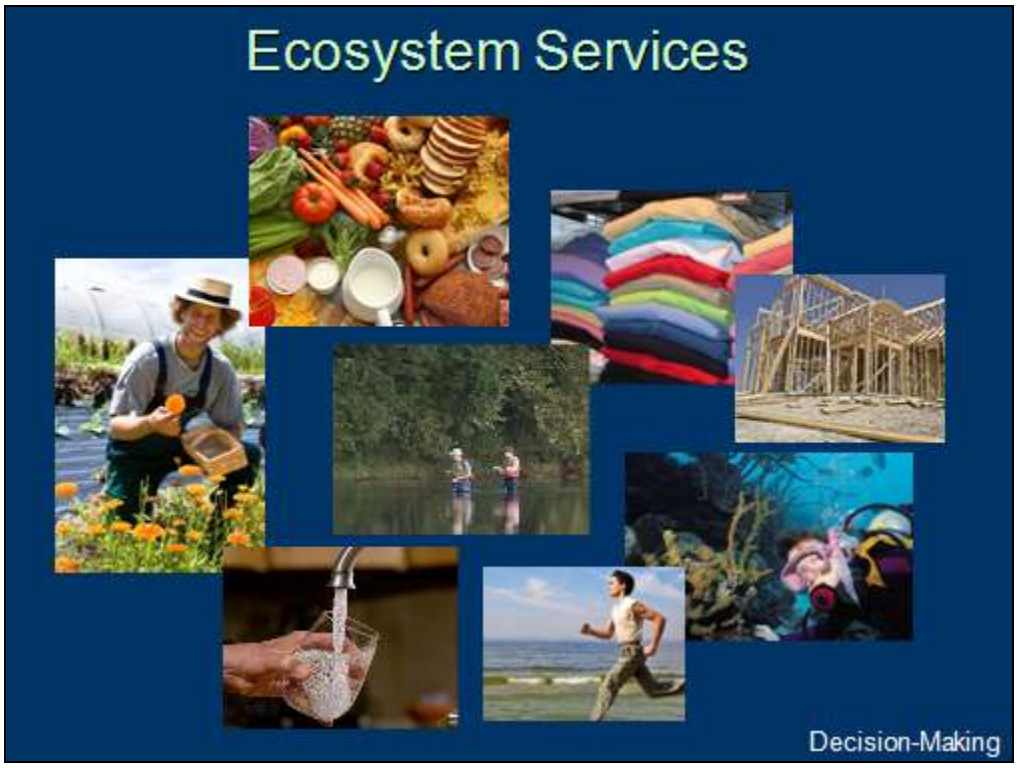
- Land-use decisions typically focus on increasing economic viability with little attention to social and ecological effects
- Natural resource management decisions (including coastal zone management decisions) may not consider land-use decisions
- Corporate/industry decisions regarding investments, products, and waste management may prioritize short-term economic gain
- Farmers and individual property owners may make decisions that affect their land without considering effects on downstream waters or neighboring land
- Scientists do not always investigate issues most important to decision makers
- Decisions are not always coordinated across geographic "boundaries" (e.g., the many property, city, county and state jurisdiction lines in the delta region of Louisiana and Mississippi)

Decision-Making – Ecosystem Continuity

A fragmented decision process results from isolated frames of reference that ignore the continuity of ecosystems. Ecosystems exist at a particular spatial scale without regard to jurisdictional or property lines.

For example, the stream on a farmer's property does not typically begin and end on the property but rather is part of a terrestrial and aquatic system extending upstream and down. If the farmer believes he 'owns' the stream on his property, he may not consider the effects of his actions downstream. The same farmer, however, will certainly understand the concept of continuity if the actions of upstream neighbors muddy the waters and kill the fish in his portion of the stream.

The ecosystem consists of interrelated, co-existing organisms that need each other to survive. If the system becomes unbalanced, then the ecosystem fails to function in a manner that provides goods and services that we depend upon.

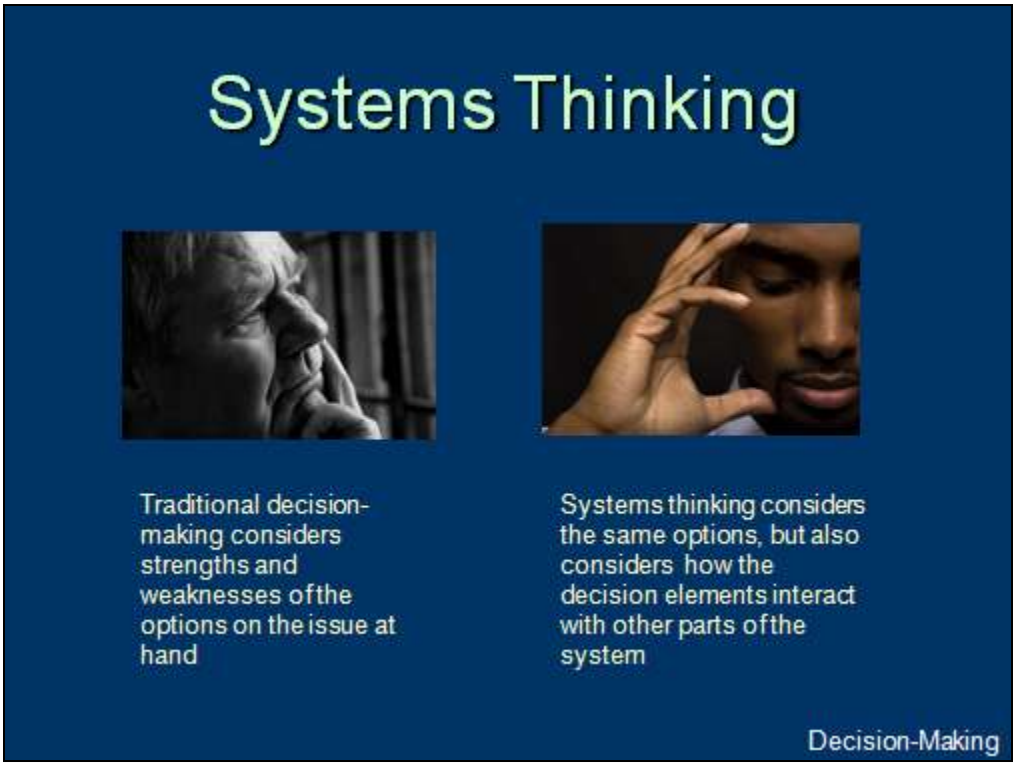


Decision-Making – Ecosystem Services

Human social and economic activities are inevitably dependent on properly functioning ecosystems. Ecosystems that are recognized and managed as a continuous system will continue to provide the natural benefits we enjoy.

- Food to eat (from farms, fishing)
- Water to drink, fish in and swim in
- Materials to build shelter and make clothes
- Opportunities for recreation, aesthetic beauty

These few examples demonstrate how much of our social and economic lives depend on the proper functioning of ecosystems. We need to consider what we take from them and what we do to them when we make decisions. This requires a 'systems' context and a 'systems' way of thinking.



Decision-Making – Systems Thinking

Traditional decision-making focuses on selecting the most logical and sensible alternative that will have the desired, short-term effect for a particular issue. Decision-makers consider various alternatives and compare the strengths and weaknesses of each. Oftentimes, the decision-maker does not consider their decision in a larger context or "system". As a result, decisions may lead to unintended consequences, often over the longer term.

Systems-oriented thinking, in contrast, focuses on how the decision elements under consideration interact with all parts of the system. Analyzing these interrelationships can generate strikingly different conclusions than those generated by traditional forms of analysis. This is especially true when the system is dynamic and complex.

For an example demonstrating the difference between traditional and systems-oriented thinking, see a *Systems Thinking Example (Appendix B)*

Decision-Making – Impacts from Human Activities

We are all aware of contamination in our environment and the resulting loss of goods and services. However, pollution is not an intended consequence; nobody tried to pollute the waterways. Nonetheless, good ideas and good intentions can still have unintended consequences. Industries make things we use, but create waste products. Cars that we drive create smog. Homes that we build create impervious surfaces. We must contend with these realities. The best way is to include these consequences in our decision process, using a systems-based decision process.

Decision-Making – Unintended Consequences

If we engage in a fragmented decision process, without a systems framework, the chances for unintended consequences will increase. More often than not, these are negative consequences. For example, local decisions for unbridled residential development can dramatically increase impervious surfaces (e.g., roadways, driveways, home footprints). Because rainwater is not absorbed, this can lead to flooding of the new homes.

Decision-Making – Unintended Consequences

Sometimes, seemingly obvious decisions can have adverse unintended consequences. For example, we can improve agricultural productivity if we plow all suitable land, eradicate pests, and feed the plants. Yet, plowing to the edge of a stream, and applying pesticides and fertilizer to ensure rich, successful harvests will create some adverse unintended consequences.

These decisions can cause erosion from the farmland and allow sediments, contaminants, and nutrients to wash into the stream and pollute water downstream.

Ultimately, this destroys ecosystems that provide tourism, recreation, fishing and even the food and drinking water of downstream communities. Polluted water no longer provides the services we value. Moreover, the loss of topsoil into the stream requires even greater use of fertilizer on crops in ensuing years.

Decisions that incorporate the entire functioning ecosystem and connections among ecosystems will usually result in sustainable benefits. Practices in agriculture, construction, industry, and energy are all important contributors to our social and economic existence; however, they often produce unintended and unwanted outcomes. This challenges us to move from a traditional decision-making process to a more integrated systems-level decision-making process.

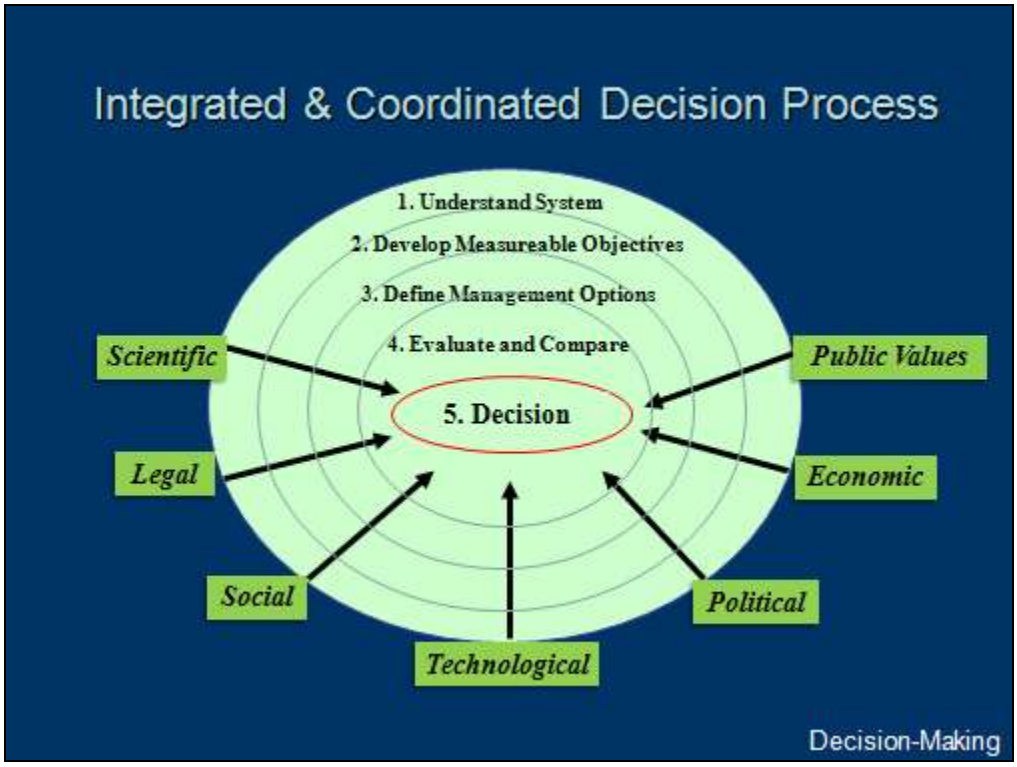
Decision-Making – Longer-Term Challenges

There are some decisions that we need to make as individuals and others that we must make as communities and nations. The cumulative effects of worldwide energy production and transportation have created global changes in environmental condition that only national and international collaboration can address. These changes and continuously increasing human populations create ever-growing threats to, and ever-growing needs for, goods and services from fully functioning ecosystems.

Decision-Making – Need for Integration

There is a need for integration, coordination, and for systems-level, decision-making processes.

- Scientists, stakeholders, and decision-makers need to be informing each other
- Decision-makers need to communicate with scientists about the decisions to be made so the scientists can do the appropriate research
- Stakeholders need to provide their input regarding needs and values
- Scientists need to explain the complexity of stressors and interactions in a way that is understood by all



Decision-Making – Integrated and Coordinated Decision Process

At least seven equally important factors (represented by the arrows) affect and inform decisions, and each can pass through five analytical steps (1-5) to integrate information for a decision.

Using a decision analysis approach enables decision-makers and stakeholders to incorporate systems thinking in the evaluation of very complex options with uncertain data and information. This brings stakeholders and decision-makers together in an integrated process. Decision-makers and stakeholders operate collaboratively to:

•Develop a common understanding of the entire system including the science, political situation, regulatory, social, and institutional settings

•Develop common, measureable objectives focusing on what they want the system to be able to do over the long-term

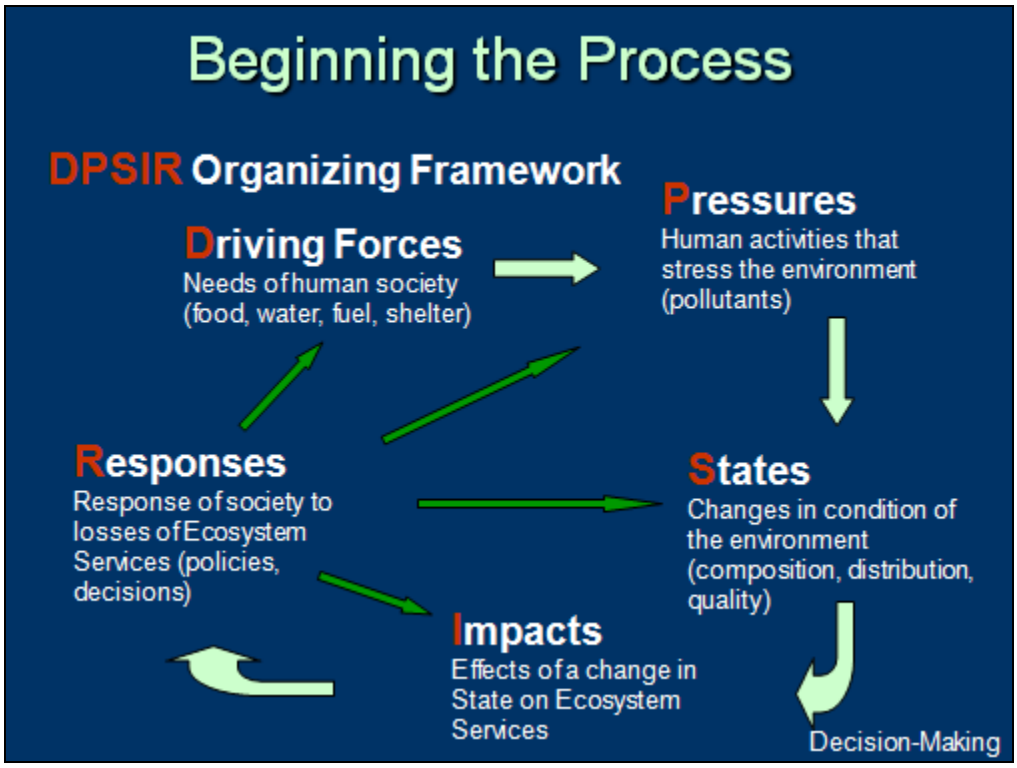
•Define possible management options, or set of actions, they may take to meet the objectives

•Evaluate and compare options to determine the social, economic, and ecologic consequences of each option

•Take action, either to select an option (with monitoring and adaptation over time) or to collect additional information

Decision-Making – The Result

- Decisions consider economic, social, and ecological impacts
- Decisions are systems-oriented
- Decision-makers can evaluate complex trade-offs in a systematic, objective way
- All decision-makers and stakeholders work collectively to decide the best course of action
- Decisions are proactive and protective (rather than reactive after damage has occurred)
- Our children (and future generations) have access to a world that can provide the ecosystem services they need to live, grow, and prosper



Decision-Making – Beginning the Process

The DPSIR Framework can help us begin the process by organizing our system-level decision in a conceptual way. We will identify

•Drivers: human needs (sometimes thought of as fulfilled by economic sectors)

•Pressures: human activities to fulfill needs that stress the environment

•States: changes in the condition of the environment

•Impacts: effects of a change in state on ecosystem services

•Responses: reactions to losses of ecosystem services

The DPSIR Framework can assist in many steps of the decision analysis process. It will allow stakeholder/decision-maker groups to:

•Generate a common understanding and organized, conceptual model of the system including the scientific, political, regulatory, social, and institutional settings

•Generate a common understanding of how human activities affect ecosystems and vice-versa

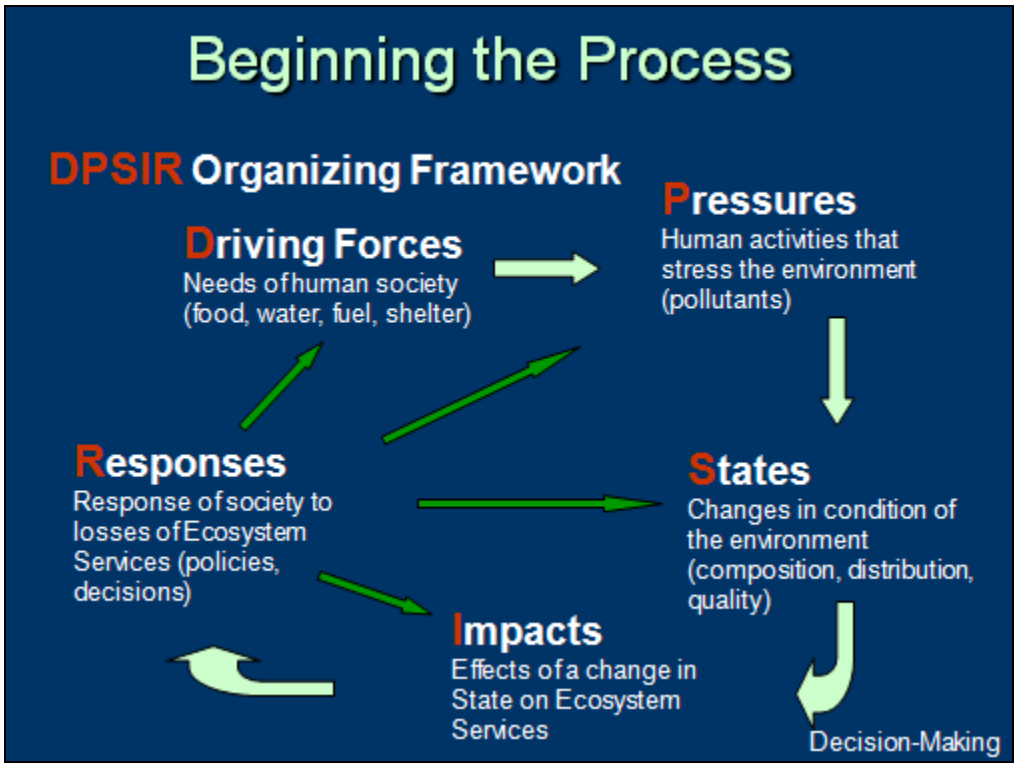
•Conceptualize and visualize desired outcomes leading to the development of measurable objectives

•Provide a context to develop responses to achieve those outcomes

•Conceptualize impacts based on current drivers, pressures and states, and conceptualize impacts of responses

•Determine which responses need further evaluation in a quantitative decision analysis process

•Decide if decision-makers need to collect additional data or perform additional research

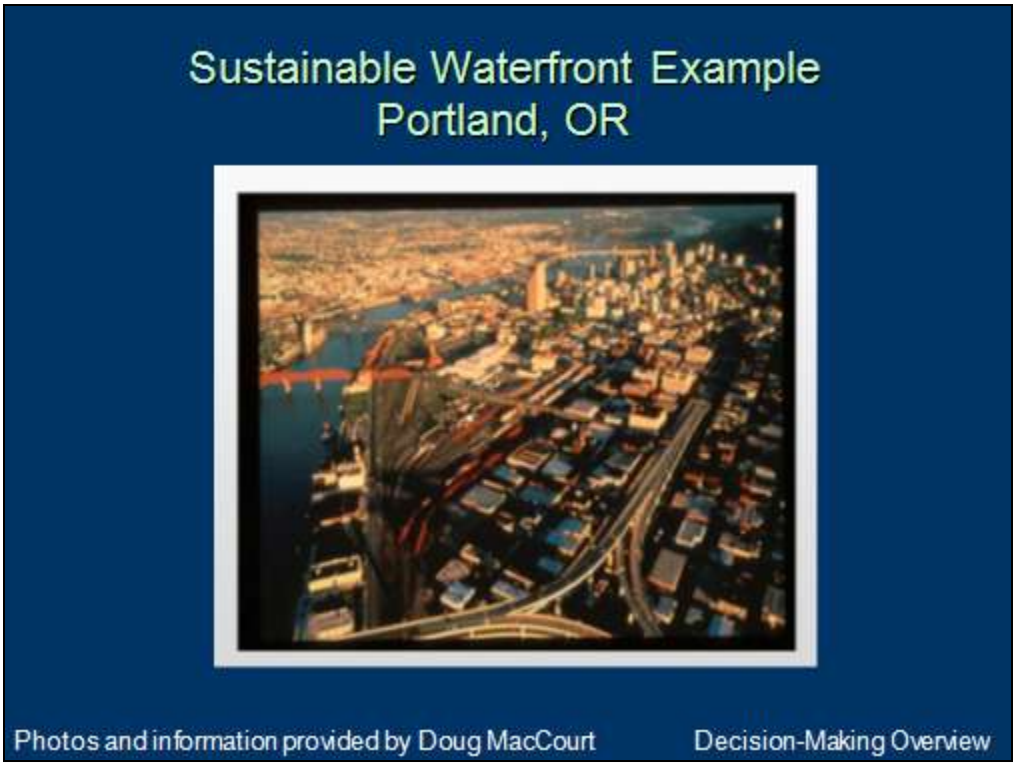


Decision-Making – Beginning the Process

A recent commentary *(Curran 2009)* suggests that there are currently no single programs capable of delivering overall support (including social and economic perspectives) to environmental decision-making, and emphasizes the need for further research on viable decision-support frameworks. Application of the DPSIR framework will better ensure that we do not overlook critical relationships and that we recognize the full consequence of a decision to related parts of the larger system *(O'Connor & McDermott 1997)*.

To learn more about how to develop a DPSIR, proceed to Module 2.

Appendix A: Complex Decision Example



Complex decision: Sustainable Waterfront Example

As an example of a complex decision, consider the challenges faced by the City of Portland, OR. Portland is Oregon's oldest, largest, industrial shipping and commercial center. With the goal of promoting "a sustainable future that meet's today's needs without compromising the ability of future generations to meet their needs," the City of Portland has committed to:

•Support a stable, diverse, and equitable economy.

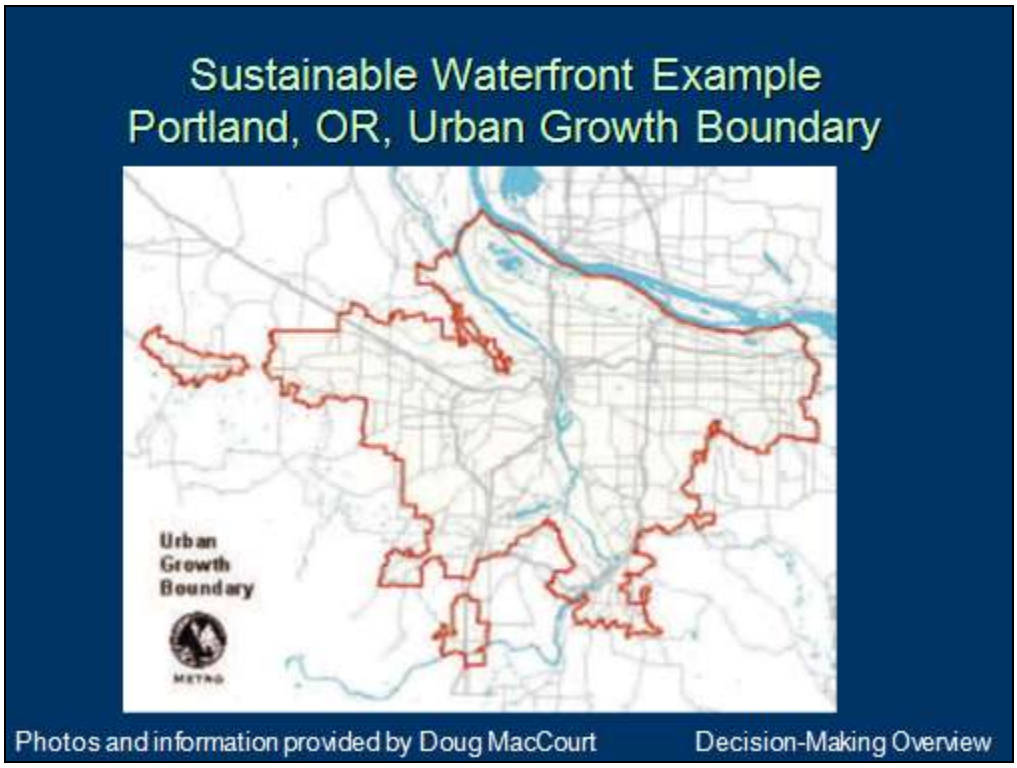
•Protect the quality of the air, water, land, and other natural resources.

•Conserve native vegetation, fish, wildlife habitat, and other ecosystems, including the endangered salmonids.

•Minimize human impacts on local and worldwide ecosystems.

The City of Portland wanted to balance the region's growth by maintaining a compact urban area with easy access to natural areas (including the harbor), open space, farm, and forestlands. Above all else, Portland's *Central City Plan Fundamental Design Guidelines* call for integration with the Willamette River: "The river is the Central City's most significant geographic feature and acts as the binding element," the *Guidelines* state. "The river is also a center for activity; important to Portland's overall economic health and livability. The river's importance is measured not just as a working river, but also in terms of its aesthetic, recreational, and tourism potential."

The City of Portland also wanted to protect the industrial land resources and promote job-based growth on industrial lands served by existing infrastructure. Redevelopment of several large Brownfield sites concentrated in the urban waterfront became a key policy objective of the city and the region.



Complex decision: Sustainable Waterfront Example

One constraint faced by Portland was to achieve these goals while managing to their urban growth boundary (red line on map). The urban growth boundary is one of the tools used to protect farms and forests from urban sprawl and to promote the efficient use of land, public facilities and services inside the boundary. Land inside the urban growth boundary supports urban services such as roads, water and sewer systems, parks, schools and fire and police protection that create thriving places to live, work and play. Inside the boundary, urban growth is permissible, but outside the boundary, land and natural resources are protected.

Other benefits of the boundary include:

•motivation to develop and redevelop land and buildings in the urban core

•assurance for businesses and local governments about where to place infrastructure needed for future development

•use of limited resources to make existing roads, transit service and other services more efficient

The urban growth boundary was not intended to be static. Since the late 1970s, the boundary has been moved about three dozen times. The Metropolitan Regional Government (Metro) is responsible for managing the Portland metropolitan region's urban growth boundary and is required by state law to have a 20-year supply of land for future residential development inside the boundary. Every five years, Metro is required to review the land supply and, if necessary, expand the boundary to meet that requirement.

In 2007, the Oregon legislature enacted a law that allowed the three Portland area counties (Clackamas, Multnomah and Washington) and the metropolitan regional government (Metro) to work together to identify land suitable for future urban development (urban reserves) as well as land suitable for long-term protection of farms, forests and/or natural areas (rural reserves). This regional process for identifying Urban and Rural Reserves was designed to meet these needs for the Portland Metropolitan Area for the next 40-50 years.

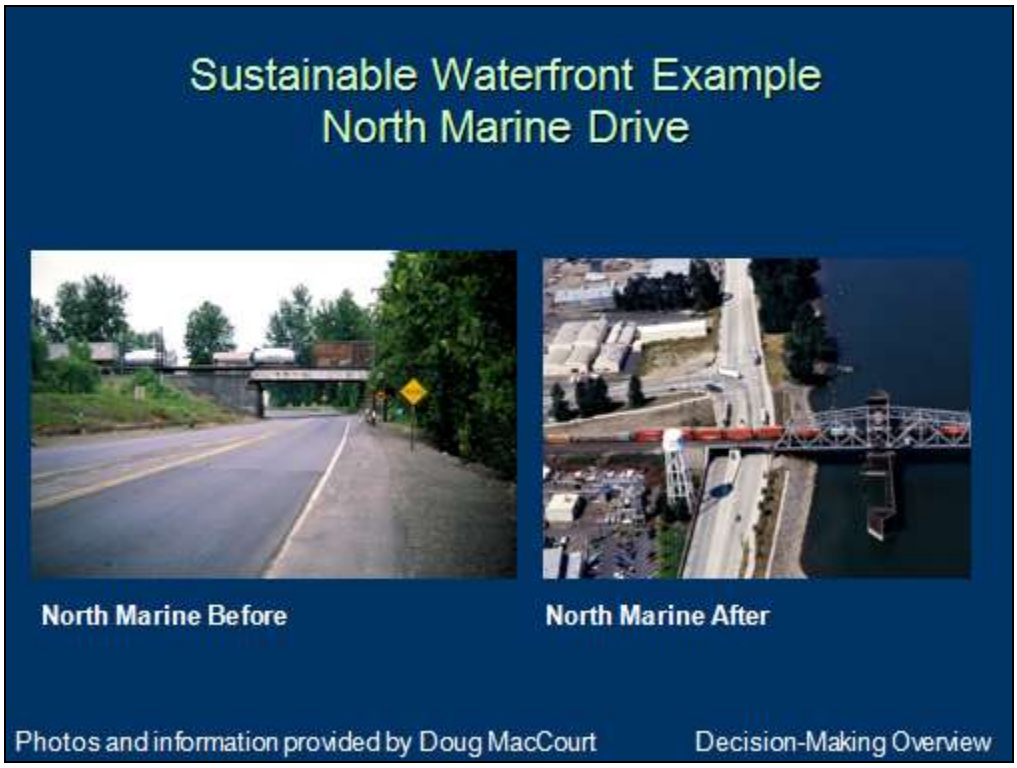
Complex decision: Sustainable Waterfront Example

The River District encompasses about 250 acres in northwest Portland. The District was historically a rail, shipping and warehouse area. In 1992 a handful of business leaders and property owners began working with the city to forge an overall vision for the River District. They developed a plan and public/private financing strategy for transforming the rail yards and gritty industrial properties into a densely populated neighborhood that would be oriented to the Willamette riverfront.

Testing conducted in 1997 determined that soil contamination in the area was pervasive. For this reason, 70 acres were designated a Brownfield site. A Brownfield is a site where contamination – or the possibility of contamination – is preventing use or redevelopment. This issue posed the greatest redevelopment challenge, particularly for residential development.

Brownfield redevelopment is a smart land use. Brownfield sites are generally located in urban centers and have existing transportation systems. Cleaning up and reinvesting in these sites protects the environment, reduces blight, and takes development pressures off green spaces and working lands. However, communities are often reluctant to consider Brownfield sites for redevelopment because of the high cost to achieve stringent cleanup standards (which can often exceed the market value of the property) combined with the potential liabilities imposed under traditional federal and state environmental law.

The public/private financing was critical to overcoming this challenge. The River District is a bold statement in quality inner-city development. It has been transformed into a vibrant urban community, with multiple historic neighborhoods, integrated affordable housing, an artist community, and a developing waterfront on the Willamette River. Situated in the heart of the River District, Union Station is the most visible and architecturally distinctive building in the area.



Complex decision: Sustainable Waterfront Example

The Rivergate Industrial District is Oregon's primary gateway for international trade. A project planned jointly by the City of Portland and U.S. Department of Transportation (DOT) has provided increased access to the city's only deepwater port and renewed development along the urban riverfront.

The Federal-aid Highway Program provided $14.6 million of the $25 million cost for completing the North Marine Drive Project, which involved relocating a road through contaminated land to provide access from Interstate 5 to the deepwater terminal. The new road, with additional wider lanes, improves the efficient operation of the port and has made the property more desirable for development. The project also improved access to recreational opportunities at Kelly Point Park at the confluence of the Willamette and Columbia Rivers and protected nearby wetlands from encroachment.

Complex decision: Sustainable Waterfront Example

The City of Portland developed a plan to achieve a sustainable urban waterfront, and the decisions that went into this plan were very complex. The City had to balance the desire to protect future ecosystem services with existing economic and societal needs. The amount of uncertainty about how these systems interact complicated the decisions. If the decision-makers placed too much emphasis on economic development, then human and ecological health would suffer. However, the industrial sites provide jobs and wealth to the region. Multiple options for where to place the industry, housing, office space, transportation, retail, and open space were evaluated and trade-offs were made. There was an inherent conflict between those who value economics above future ecosystem services and vice versa. These issues had to be resolved.

For more information:

City of Portland: South Waterfront (http://www.portlandonline.com/planning/index.cfm?c=34291)

North Marine Drive (www.ampo.org/assets/library_3/5_brownfields.pdf)

Portland Development Commission: River District (http://www.pdc.us/ura/river.asp)

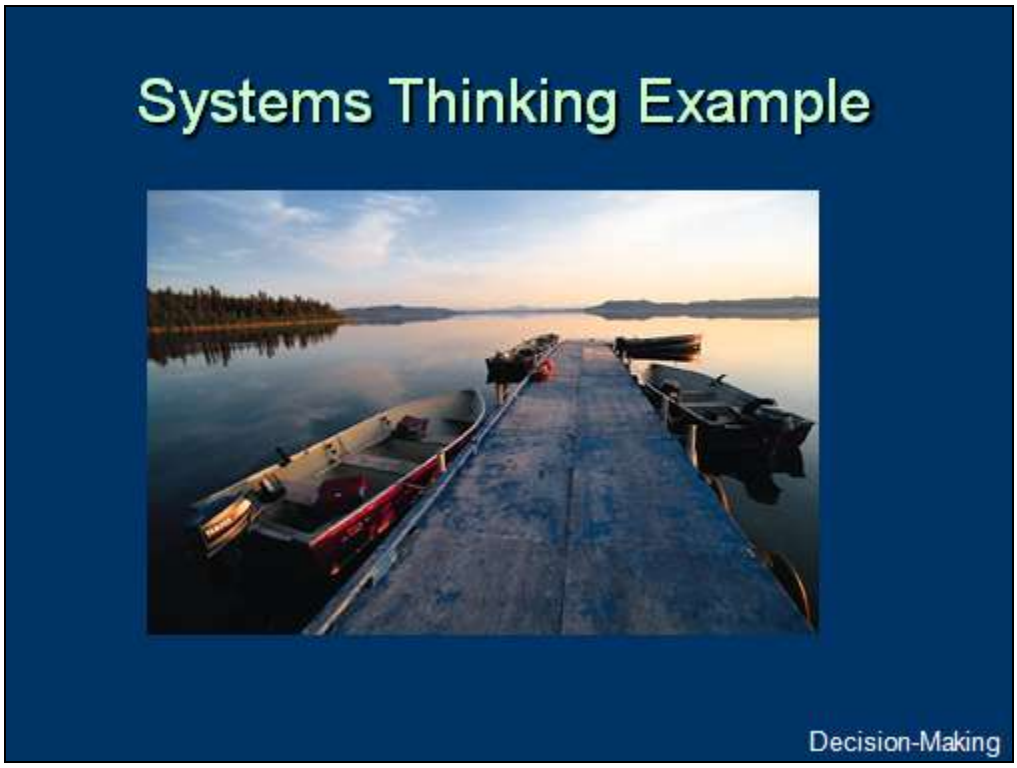
Willamette Industrial Urban Renewal Area (http://www.pdc.us/ura/willamette-industrial/default.asp)

Downtown Waterfront Urban Renewal Area (http://www.pdc.us/ura/dtwf/dtwf.asp)

2040 Plan (transportation) (http://www.portlandonline.com/transportation/index.cfm?&a=87208&c=36900)

City of Portland, Bureau of Planning and Sustainability (http://www.portlandonline.com/bps/index.cfm?c=34250)

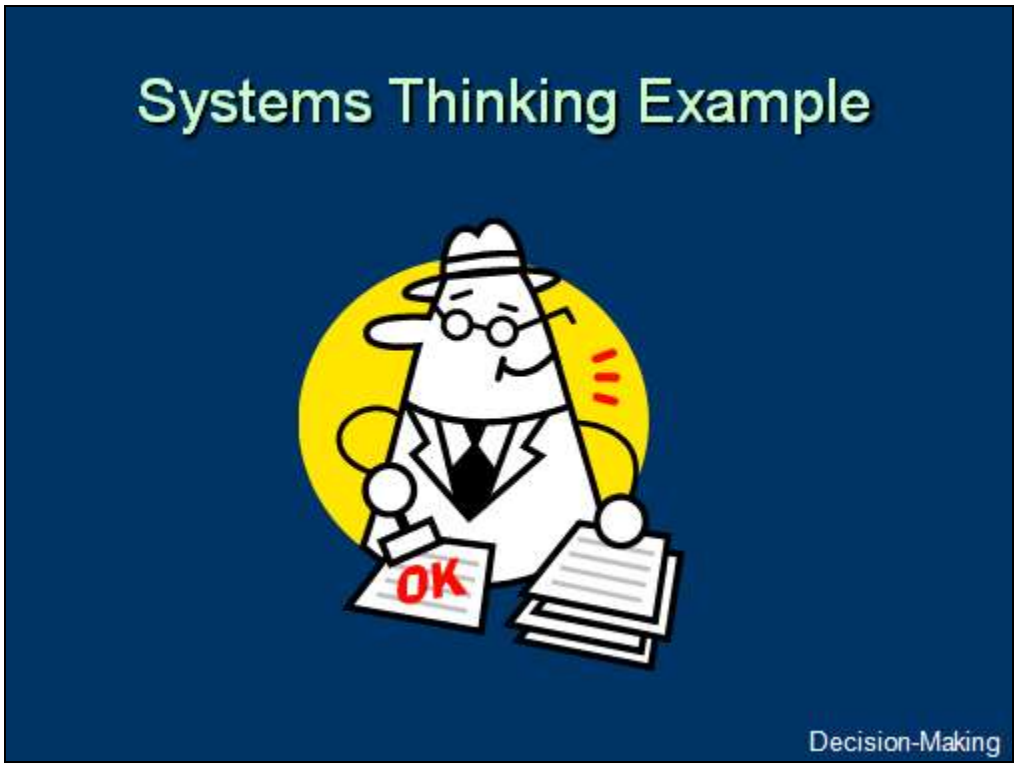
Appendix B: Systems Thinking Example



Systems Thinking Example

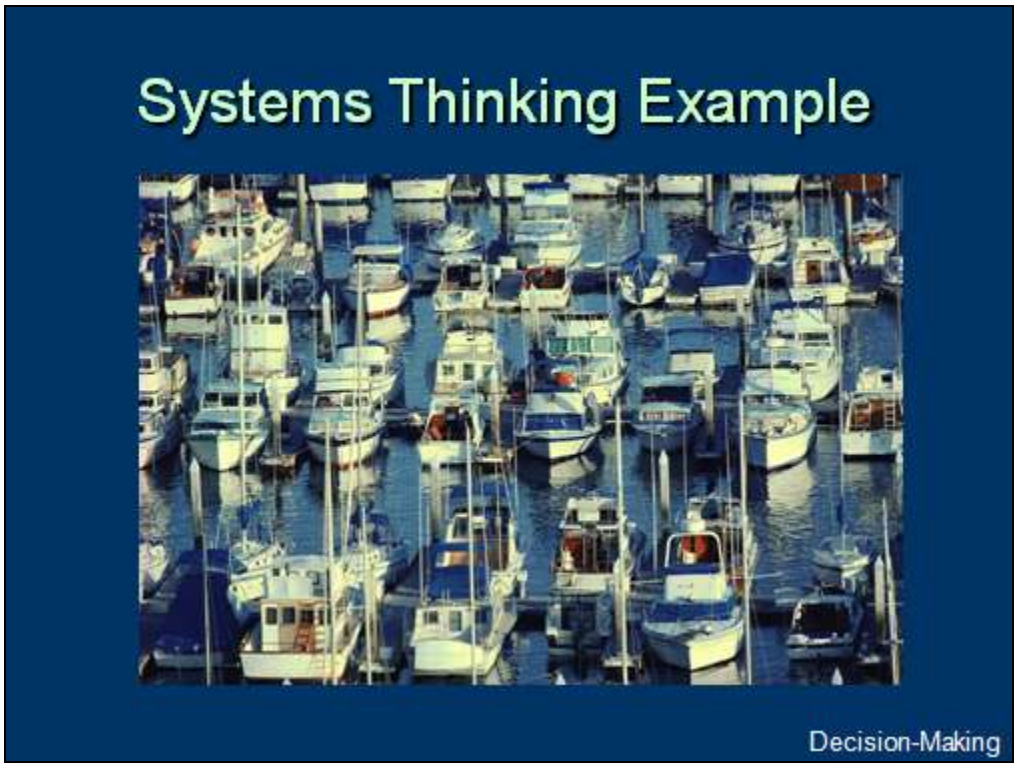
Many individuals value ecosystem services represented in this picture – a calm, peaceful, beautiful place to relax, fish, and swim. A single dock with a few boats provides one set of ecosystem services.

This picture can easily change, however, if a local official must grant dock permits without being able to consider how that decision will change the system.



Systems Thinking Example

In one coastal community, a local official reviews a request for a proposed dock to determine if that dock will negatively affect water quality. If that requested dock does not negatively affect water quality, then the local official must issue the permit. While multiple docks could negatively affect water quality, the permit reviewer cannot consider cumulative impacts or system-level effects. The next slide illustrates the result.



Systems Thinking Example

Officials have issued many dock permits. The cumulative impacts of these multiple docks on water quality, recreational aspects, and aesthetic beauty are significant. Motor boat traffic is increased and this causes air and water pollution – not to mention noise pollution. The recreational aspects of the area have also changed. Previously, a few rowboat-fisherman and swimmers used the area. Now, however, those groups are not able to use the area for those recreational activities. The entire character of the area has changed.

Change is not necessarily a bad thing, but those making the change should understand the consequences of the change before making a decision. If decision-makers had used a systems approach, they would have considered the cumulative effect of multiple docks prior to issuing the permits.

Systems-level thinking allows one to reflect on interconnections and system feedbacks. It also encourages decision-makers to think about problems and solutions with an eye toward the long view—for example, if we choose this solution, how might this area look in 20 years? What unintended consequences might it have?