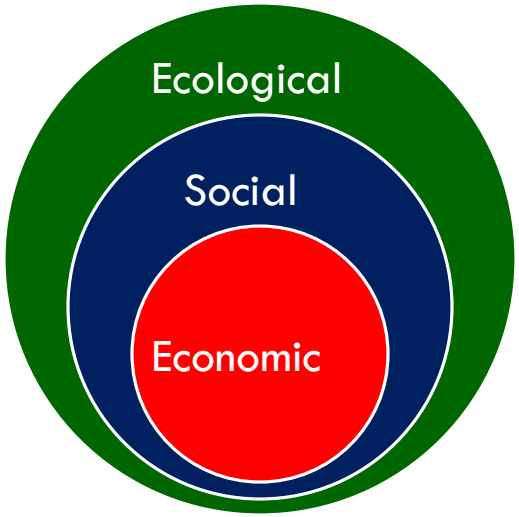
Sustainability

By C. Kohn
Agricultural Sciences
Waterford, WI

Sustainability

- **Sustainability refers to choosing practices that allow for needs to be met without compromising future generations.**
  - For example, fossil fuels are non-renewable and our current usage is not sustainable – we will run out of affordable fossil fuels some day.
  - Reducing the use of non-renewable fossil fuels ensures that future generations will have access to this source of energy.
  - Eliminating the use of highly-polluting fossil fuels ensures that less damage occurs to other renewable sources such as soil, air, water, and living species.

- **Sustainability has three components – economic, ecological, and social.**
  - Ecological sustainability means that a choice will not reduce the ability of an ecosystem to provide renewable goods and services.
  - Social sustainability means that a choice will be fair, equitable, and available to all users without major lifestyle or cultural changes.
  - Economic sustainability means that a choice will not use up an unreasonable amount of a person's income.



What are sustainable practices?

- **Examples of sustainability include:**
  - Minimizing waste at all levels (production, consumption, and disposal).
    - E.g. increasing the use of local foods instead of reliance on long-distance sources.
  - Utilizing, not fighting, natural cycles and biological systems.
    - E.g. enhancing the populations of valuable insects and bacteria rather than killing any and all insects/bacteria.
  - Preventing and eliminating pollutants and invasive species.
    - "An ounce of prevention is worth a pound of cure" applies here very well.
  - Recycling & reusing raw materials as often as possible.
  - Composting to return nutrients to a cycle.
    - This is a low-energy way to add fertility to soil as opposed to energy-intensive synthetic fertilizers.
  - Preventing soil erosion/topsoil depletion.
  - Minimizing non-renewable energy use.
  - Using practices that enhance, not reduce, biodiversity.
    - E.g. growing prairie grasses in medians instead of lawns.
  - Supporting communities, families, and social structures through economic incentives and personal relationships.
    - Sustainability does not just apply to wildlife and plants!

Common Themes of Sustainability

- **Stewardship of Natural Resources**
  - Human beings have a responsibility (economic, moral, etc.) to care for the living things around them.
  - This is known as the Land Ethic (among many other terms).
- **Systems Approaches**
  - Natural Systems exist for a reason – living species have adapted to take advantage of these systems in order to minimize the energy required for existence.
  - Adapting to these systems increases the sustainability of a practice by reducing energy inputs.
- **Long-term Planning**
  - Short, quick fixes are rarely sustainable.
  - Sustainability requires foresight, planning, investment, and education,
- **Adaptation to Change**
  - Living things change. Sustainable systems must benefit from, rather than fight ,change.
- **Sustainability Must be Socially and Economically Justified**
  - If sustainability comes at the expense of one group of people, it is not sustainable.
  - If sustainability is not affordable to a group of people, it is not sustainable.

The Dust Bowl

- **A common example of poor sustainability is the worst man-made ecological disaster on record, the Dust Bowl of the 1930s.**
  - Widespread and continual plowing of virgin topsoil in North American prairies caused extensive erosion.
- **Previously, deep-rooted prairie grasses kept the soil in place.**
  - The deep roots trapped moisture and provided structural support to the thin topsoil in a dry, arid region.
- **Rapid mechanization of agriculture enable human populations to completely change enormous areas of land.**
  - Small gasoline tractors and the introduction of the combine changed how quickly the landscape could be changed by agriculture.

Source: tiagernut.com

The Dust Bowl

- **A combination of rapid agricultural mechanization, unprecedented changes to the prairie ecosystems, and a decade-long drought led to the Dust Bowl.**
  - With no deep-rooted grasses to hold the soil and keep it moist, the topsoil dried out and turned to dust.
  - This dust was picked up by the wind, blackening the sky.
  - In some cases, these dust clouds reached as far east as New York City and Washington, D.C.

- **As a result of this, hundreds of thousands of farm families lost their income, livelihoods, and communities and contributed to the impact of the Great Depression.**
  - Books like *The Grapes of Wrath* and *Of Mice and Men* chronicled the personal devastation of this ecological disaster.

Alexandre Hogue, "Drouth Survivors" (1936). Oil on canvas, 30 × 48. The one they wanted to burn.

Source: www.ldeo.columbia.edu

Why Did the Dust Bowl Occur?

- **The Dust Bowl occurred because of a poor understanding of sustainability. Examples include:**

- **Poor Stewardship of Natural Resources**
  - Few at the time understood the obligation people have to preservation of ecosystems.
  - 99.9% of prairie ecosystems have been lost since European settlement in North America (Univ. of Nebraska, 1994).

- **Lack of Usage of Natural Systems**
  - The prairie is a natural living thing with its own systems, without which the living components of a landscape cannot survive (just like you cannot survive without a circulatory system).
  - When components of this system were lost (such as when the deep roots of prairie grasses were replaced by the shorter roots of wheat), the system that had preserved itself over hundreds of thousands of years was lost.

Source: www.popmatters.com

Why Did the Dust Bowl Occur?

- **No Long-term Planning**
  - Little to no long-term planning existed in Western agriculture at this point.
  - Large tracts of cheap land with fertile soil and a high demand for wheat led to get-rich-quick mentalities in 1800s and 1900s pioneers.

- **No Adaptability to Change**
  - Early settlers of the prairies did not anticipate nor plan for changes to the ecosystems on which they depended.
  - When those changes did occur, their only remaining option was to leave (e.g. Okies who migrated to California in *The Grapes of Wrath*).
    - Globally-speaking, we do not have the option to leave.

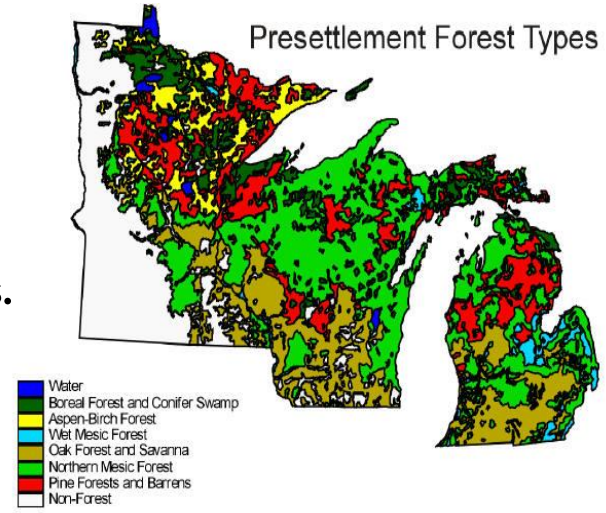
- **No Economic and Social Sustainability**
  - As a result of little or no sustainable practices, entire communities were wiped out, large numbers of people had to leave their homes, and the worst economic depression in US history was made worse.

Source: blogs.kqed.org

Sustainable Forestry

- **Forestry is an example of both poor and excellent sustainability.**
  - Up to the early 1900s, forestry was an epitome of unsustainable usage of a natural resource.
  - Modern forestry in North America is now an example of how sustainable use of a resource can be beneficial in all three areas of sustainability – ecological, economical, and social.

- **After the Northwest Ordinance of 1787 divided the Great Lakes region into townships and sections, a lot of land became the property of railroads and lumber companies.**
  - America was a rapidly growing nation, and the explosive growth of eastern cities created a strong demand for building materials.
  - White pine made a great building material and could easily be transported by floating it down rivers.
  - By the 1840s, white pine supplies were largely depleted in the East, and so the Great Lakes became the next-best source of this natural resource.



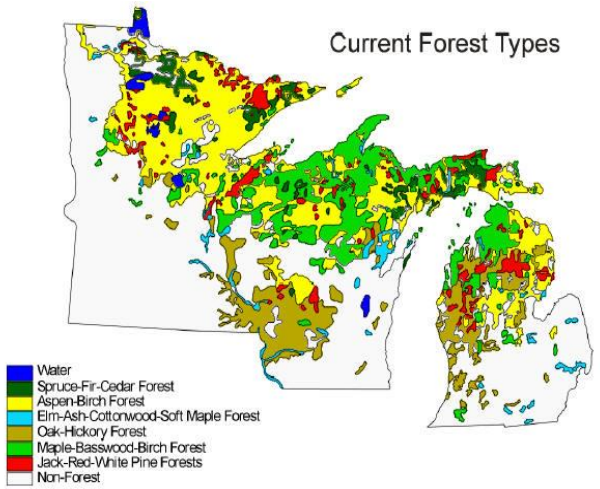
Source: uwmc.uwc.edu/geography

Wisconsin Forest Destruction

- **By 1867 it was necessary for the Wisconsin Legislature to establish a special commission to study forest destruction.**
  - Not only were pine forests being completely cleared by lumber companies, but their practices also led to widespread degradation of the natural systems that enabled the forests to grow.

- **The effects of this unsustainability culminated in 1871 with the Great Peshtigo Fire, which caused the greatest loss of life by a fire in US history.**
  - Up to 1500-2500 people died in a single day in this fire (Biondich, 2010).
  - While the Chicago Fire occurred on the same day, the Peshtigo fire was far more deadly.
  - A wall of fire a mile high and five miles wide traveled at speeds up to 100 mph across northern Wisconsin (Lutz, 2003).

- **Between 1890 and 1910 almost all economic stands of pine had been cut or burned (Stearns, 2004).**
  - By the 1920s, much of Wisconsin's hemlock trees were harvested.
  - By the 1900s, loggers had to switch to less-valuable hardwood.
  - Clear-cutting remained the dominant mode of logging, and widespread forest fires and soil erosion caused major ecological damage.



Source: uwmc.uwc.edu/geography

Wisconsin Takes Action

- **In 1897, the Wisconsin Legislature established the State Forestry Commission.**
  - The job of the Commission was to find ways to preserve Wisconsin's forests without impacting the state's economic development.
  - In 1904, E. M. Griffith was made the first State Forester.
  - The first State Forest was established in 1925 (the Northern Highland-American Legion State Forest).

- **As a result of the Great Depression of the 1930s, the state and federal forest services were able to acquire large tracts of forested land.**
  - Nicolet and Chequamegon National Forests were established in 1933.
  - Today 28 state forests exist with over 2 million acres of protected land.

Source: www.dailyyonder.com

Governance of Wisconsin Forests

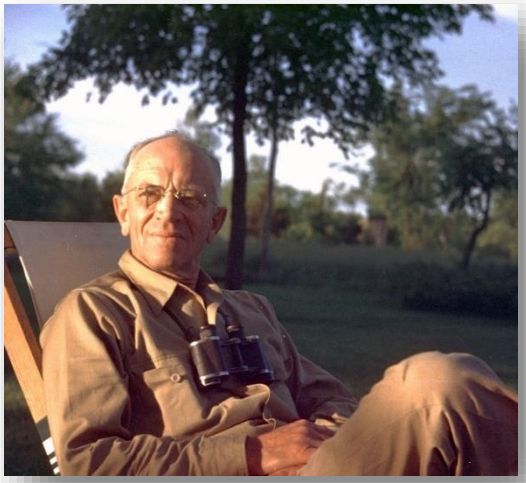
- **“Wisconsin state forests are governed by Wisconsin Statute 28.04.**
  - This states that "The Department shall assure the practice of sustainable forestry and use it to assume that state forests can provide a full range of benefits for present and future generations."
  - Here 'sustainable forestry' is defined as the practice of managing dynamic forest ecosystems to provide ecological, economic, social, and cultural benefits for present and future generations.
    - Source: "History of the lake States forests: natural and human impacts," by Forest W. Stearns

Source: www.foresthistory.org

Wisconsin's Forestry Impact

- **As a result of the hard-learned lessons on sustainable forestry, Wisconsin and many Great Lakes states contributed to a national change in how sustainability is viewed.**
  - At the forefront of this movement was Aldo Leopold.

- **Aldo Leopold is considered the father of the science of Wildlife Management and US wilderness management.**
  - As a professor at UW-Madison, Leopold published the first textbook on wildlife management in 1933.
  - Leopold became the nation's first academic chair of wildlife management in 1934.
  - In 1935, Leopold restored the natural landscape on a property near Baraboo, WI.
    - It was here that Leopold wrote *A Sand County Almanac*, considered to be one of the most respected books about the environment ever published.

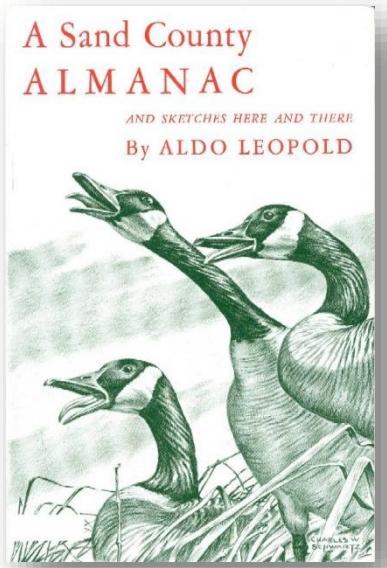


Source: www.prx.org

The Land Ethic

- **Leopold's 'Land Ethic' defined a new relationship between people and nature.**
  - The "Land Ethic" essay was published in 1949 as the finale to *A Sand County Almanac*.
  - This idea set the stage for the modern conservation movement.

- **Leopold knew that ethics exist among groups of people for the mutual benefit of all.**
  - In other words, the more ethically we treat other people, the more ethically we will be treated and the better our lives will be.
  - His idea was that the concept of this 'community' should be enlarged to include non-human elements.
    - This would include soil, waters, plants, and animals.
      - Collectively, Leopold considered these elements together to be "*the land*."



Source: www.artintheage.com

The Land Ethic, Simplified

- **Leopold's "Land Ethic" means that we have a moral and ethical obligation to treat natural resources with the same respect and integrity that we would and should treat other people.**
  - Prior to the Land Ethic, natural resources were only viewed as an economic good.
  - Leopold's philosophy meant that before we consider the economic implications of our use of natural resources, we must consider our moral obligations to ecosystems, living organisms, and future generations.

- **Leopold's ideas started a complete reversal in the way Americans viewed natural resources.**

Source: blogs.scientificamerican.com

Sustainable Forestry

- **As a result of the Forestry Commission, Aldo Leopold, and many other influences, forestry in Wisconsin and the US began to become sustainable and ecologically valuable.**
  - Modern forestry today works under the understanding that in order for logging to be profitable in the long run, it must ensure the permanent existence of healthy forests.

- **Sustainable forestry necessitates the knowledge of each kind of tree's unique requirements and adaptations, as well as the threats and opportunities each forest ecosystem provides.**
  - A trained forester will be able to identify opportunities to improve a forest ecosystem's sustainability.
  - Foresters do this through careful selection of trees to harvest and elimination of threats such as disease, insect attacks, and fire.

Source: www.bls.gov

Sustainable Forestry

- **Sustainable forestry is the harvest of trees at a rate and in a way so that as many or more trees grow to replace those that are lost.**
  - Sustainable forestry is not just the removal of trees but also the management of the forest itself.

- **Foresters must…**
  - Regulate the spread of fire and disease.
  - Identify and control harmful insects and pests.
  - Prevent harmful plants from crowding out beneficial trees.
  - Ensure that trees have access to sunlight, water, nutrients, and space.
  - Prevent water pollution, soil erosion, and other harmful potential byproducts of logging.

Source: f2.washington.edu

Sustainable Forestry Techniques

- **Foresters have a range of options to improve a wooded area, including…**
  - Improvement harvest: removing trees that have poor health so that younger, more vigorous trees can grow in their place.
    - The presence of sick or dying trees puts healthy trees at risk.
  - Timber Stand Improvement: needed if a forest isn't ready for a harvest of trees.
    - This includes removing weeds, invasive species, and vines; removing cull trees (trees with no usable wood); and pruning (removing excess branches from a tree to allow it to put more of its energy into making wood).
  - Diversity improvements: these are practices that encourage forests to have a wide diversity of native species.
    - This can even include prescribed clear-cutting so that shade-intolerant species such as aspen can grow.
    - It may also include establishing areas that are untouched in order to provide old-growth forest tracts.
  - Regeneration: management of a forest that promotes the growth and development of new trees.
    - This involves supporting and maintaining the growth of healthy, valuable, native trees in a forest.

Source: www.careerrelay.com

Final Word

- **Any sustainable practice should entail the following:**
  - Meet legitimate human needs for food, fiber, and fuel.
    - Examples of *fiber* include wood, wool, cotton, etc.
  - Protect the natural resources that supply food, fiber, and fuel to human populations.
  - Protect the natural systems that supply the natural resources needed by humans.
  - Prevent unnecessary waste of food, fuel, and fiber.
  - Support and even use natural biological cycles and systems in the production of food, fiber, and fuel.
  - Assure the economic, social, and cultural well-being of the people who sustainably provide food, fuel and fiber.