

WEA BRIEFING P A P E R S



This Wild Farm Alliance Briefing Paper is part of a series that explores many of the issues that define and distinguish the concept of farming with the wild.

Each paper focuses on a particular issue set in the context of reconnecting food systems with ecosystems. We are striving to bridge the gap between stewardship farming and wildlands conservation. To obtain other papers in this series, or to learn more about our programs, contact the Wild Farm Alliance.

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Water: Life Blood of the Landscape

Required by all living organisms, water circulates food, nutrients, and energy through ecosystems, thus inextricably linking everything to everything else. With water, deserts and seasonally dry lands transform into green oases of agricultural fields, and communities thrive. Without water, there is no life, no community, no economy.

While agriculture provides food and fiber for an ever-increasing population, there is growing competition for the world's limited freshwater supplies among agricultural, urban, and wildlands users. Agriculture accounts for 70% of the freshwater use in the world. If farms and ranches manage water wisely, they can support and benefit from the delivery of nature's services, such as nutrient cycling, erosion control, and clean water.

Freshwater Ecosystems

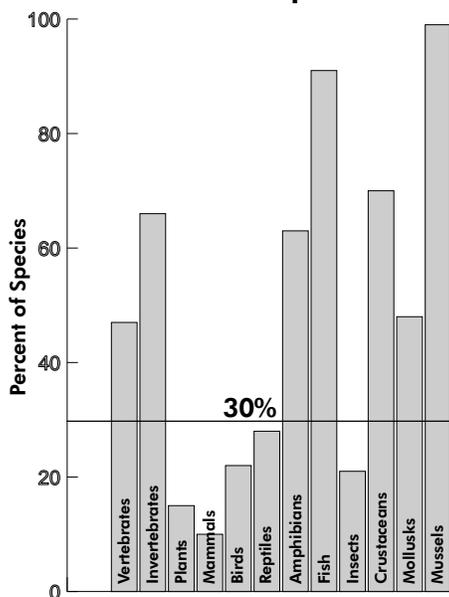
Agriculture imparts a heavy burden on the freshwater ecosystems. Surface streams are being depleted, lakes are shrinking due to diversions, wetlands are severely impacted, and aquifers are over-drafted. Pollution further limits these dwindling supplies. The greatest loss of species and habitat by far, more than those on land or in the ocean, are in freshwater ecosystems. Approximately 30% of the protected species and the species proposed for protection in the U.S. are listed because of water resource development.

Replumbing Natural Systems

Dams and other water construction projects dramatically affect bird, fish, mammal, reptile, amphibian, insect, and plant abundance and diversity by drying up wetlands, destroying riparian areas, and altering the seasonal flow patterns of rivers required by many species for their survival. Just 2% of all U.S. rivers now run unimpeded by dams.

Wetlands purify water, prevent erosion, support fish and wildlife, reduce flood damage, and add to the aesthetic value of the landscape. In all, more than half of the wetlands have been lost in the lower 48 states. Today, wetland conversion is down to 10% of what it once was, but it still continues at a rate of 80,000 acres per year. Throughout much of the country, people have drained and tilled wetlands to plant field crops, but this has resulted in water flowing more quickly into creeks and rivers, causing flooding downstream during storms.

U.S. Imperiled and Protected Species Harmed by Habitat Destruction Due to Water Development



Water development affects, on average, 30% of endangered species, and a disproportionate number of these live in aquatic environments (after Stein, Kutner, and Adams, 2000).

Consumer demand for food from sustainable farms must be built, and the best place to start is with people who are concerned about the environment but haven't made the connection between their grocery list and the endangered species list.

—Dana Jackson,

The Farm As Natural Habitat

Over-Drafting Nature's Bounty

It has been estimated that U.S. irrigation is 50% inefficient. U.S. farmers rely on groundwater for 40–45% of their irrigation needs. One-quarter of this water is not replaced, causing over-drafts of at least 1 foot per year under almost half of the groundwater-irrigated lands. The Ogallala aquifer, which underlies parts of Texas, New Mexico, Colorado, Kansas, Nebraska, Wyoming, and South Dakota, is currently pumped at 25 times more than its natural rate of replenishment. About 40% of this water is used to produce grain for cattle.

Clean Water?

Nitrate contamination in wells is thought to be directly related to animal waste and nitrogen fertilizers. A study examining 560 drinking water wells in the United States found at least one pesticide in each, and nitrates in more than half. In California, more than 2,700 wells had concentrations of chemicals exceeding the state's recommended public health limit.

Water diverted from rivers typically returns polluted with agricultural nutrients, chemicals, sediments, or human or industrial waste. According to the Environmental Protection Agency, 60% of the rivers are "impaired" due to agricultural runoff. Polluted waters create both chronic and acute problems for fish and wildlife, as well as for humans. Most states periodically issue warnings about contaminated fish.

Land stripped of its native vegetation loses its ability to absorb water and slow down runoff and soil erosion. Excessive sedimentation clogs up fish spawning areas and decreases the storage capacity of U.S. reservoirs by 22% annually. Animal manure in the United States exceeds human waste by 130-fold, yet most of this animal waste reaches waterways and groundwater untreated.

Excess nitrogen and phosphorus in freshwater ecosystems stimulate growth of algae, leading to eutrophication and loss of oxygen, fish kills, loss of seagrass beds, degradation of coral reefs, and loss of fisheries and shellfish industries. Degradation is especially apparent at the mouth of the Mississippi River in the Gulf of Mexico where nitrogen, phosphorus, and 40 different pesticides have created an 8,500 square-mile hypoxic dead zone. Livestock operations and the heavily subsidized corn and soybeans grown in midwestern fields contribute about two-thirds of the nitrogen runoff to the Mississippi River. It was not always this way. One hundred years ago, livestock was pastured instead of concentrated in feed lots, and farmers rotated wheat, oats, barley, and rye with alfalfa crops and pastures, which were naturally fertilized by the animals.

Salting the Soil

It is currently estimated that 23% of the nation's irrigated lands are damaged by salinization, which occurs most often in arid climates where poor irrigation management and high evaporation rates hasten the build-up of salts in the soil. Flushing the soil does work to remove salts, but then the question arises as to where to put the leachate—in evaporation ponds and wildlife refuges? In the western United States, 200 wildlife refuges and management areas receive water from the Department of Interior agricultural irrigation and drainage projects. These waters not only have high salt content, but often also contain selenium at levels dangerous to wildlife and to ecosystems.

Western Woes

Freshwater systems are impacted most directly in the arid West; the 18 arid states most dependent on irrigation frequently consume about 70% of their stream flow. The Colorado River scarcely makes it to the Gulf of California, and last year the Rio Grande dried up before it reached the Gulf of Mexico. Much of the West's water development has been subsidized through federal projects, exacting a high toll on freshwater ecosystems.

Water's Future

The era of building dams, diverting and channelizing rivers, and dredging wetlands is winding down in the United States. The easily dammed and dredged sites have been developed, and what's left is prohibitively expensive. As the world population expands, freshwater resources must be managed more effectively to meet the demands of functioning ecosystems and agriculture. Water will have to flow increasingly from conservation, recycling, and improved efficiency rather than from new water projects. Restoring rivers, wetlands, and fisheries will be the major undertakings of this century.

Raising Crops and Livestock That Fit the Climate

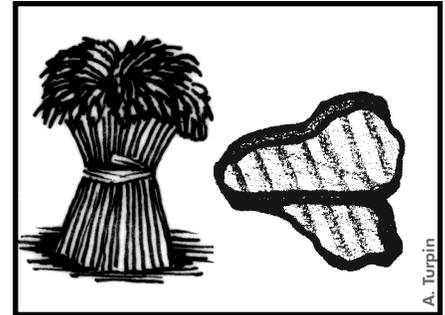
Growing crops that suit the region's climate conditions makes sense economically and ecologically. For example, roughly 88% of the land devoted to corn lies in regions that receive summer rain, making them suited for the crop. Yet in Nebraska, Kansas, Texas, and Colorado, immense volumes of freshwater from streams and depleted groundwater supplies are used to produce a crop that grows cheaper in wetter areas to the east. Likewise, raising cattle in arid parts of the West may not be the best use of resources. Without irrigated pasture and hay production, most of the western range cannot provide enough forage for cattle feed.

Keeping Freshwater Fresh

Nutrition of a crop can be maintained with precise fertilizer applications matched to the plants, so the balance neither leaches nor runs off. Testing for nutrient levels in plants, soils, and composts can minimize over-fertilization. Cover crops help by fixing nitrogen and converting residual nitrogen to stable, plant-useable forms. Crop rotations integrated with livestock or leguminous crops more closely mimic natural prairie cycles and help to equate nitrogen availability with nitrogen demand. Pasturing animals naturally spreads out manure, and fencing cattle from—or closely monitoring them in—sensitive riparian areas keeps waters free of excess nutrients and streams blanketed with a healthy vegetative filtering system and habitat for wildlife.

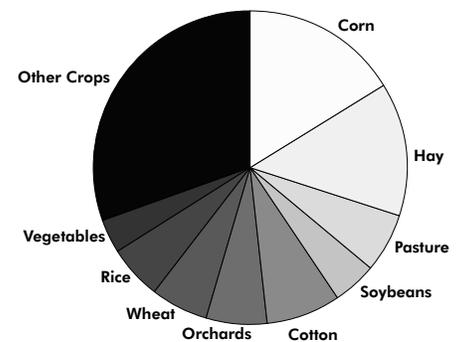
Fields protected by cover crops or crop stubble during the rainy season can help to conserve soil. This also allows water to recharge the aquifer instead of being lost to overland sheet flow and evaporation. Mulching, planting grassed waterways, and combining crops and trees on slopes saves water and controls erosion. Planting canal banks and roadside edges with natives can displace weeds and stabilize eroding slopes that would otherwise be treated with herbicides or scraped to reduce noxious weeds. Restoring frequently flooding marginal fields to wetlands and steep marginal lands to wildlife habitat can increase biodiversity and save soil and money.

Contouring plant beds, terracing, and planting native vegetation in non-crop areas improves water quality by slowing down, filtering, or absorbing runoff. During the



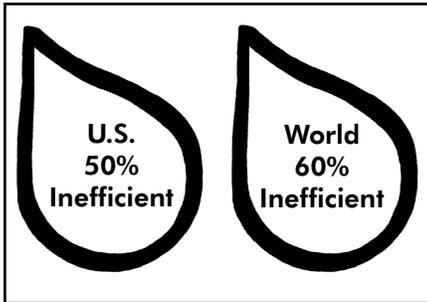
It takes only 25 gallons of water to produce a pound of wheat and up to 5,000 gallons to produce just one steak.

Percent of Irrigated Acreage By Crop



Corn and hay top the list for the most irrigated lands, and not far behind are pasture and soybeans. Consider that most of the harvested corn and soybeans, and all of the hay and pasture crops go to feed livestock.

Dust Bowl days, Coon Valley, Wisconsin, experienced some of the worst erosion on record. Hillsides had gullies so large horses could be buried in them, bottomlands silted up to rooftops, and the native brook trout hung on in isolated tributaries. Since that time, farmers throughout the watershed have used conservation practices in order to hold vital topsoil in place and ultimately supply clean water to trout. According to James Radke of NRCS “A graduated system of contour strip cropping on milder slopes, grazing on the steeper slopes, and set-asides on the steepest slopes was adopted.” Today, more than 300 miles of streams are classified as trout waters in Coon Valley and surrounding areas.



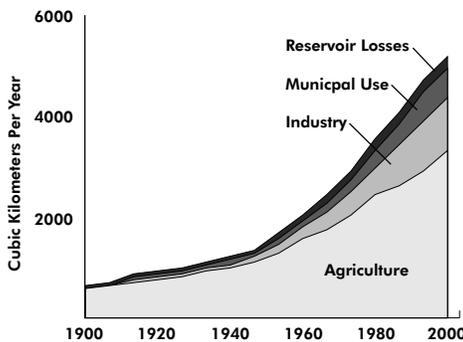
Fifty percent of U.S. agricultural irrigation is inefficient; 60% of the world's agricultural irrigation is inefficient.

Irrigating More Efficiently

Less water would be taken from rivers and aquifers with improved irrigation efficiency. While most of the world's farmers still irrigate as they did thousands of years ago by using furrows (gravity) to channel water across their fields, use of sprinklers, and to a lesser degree drip systems, are on the rise. Furrow irrigation is the most inefficient because of its non-uniform application and runoff, but it is cheap and low tech. Sprinklers are typically more efficient than furrowing water, especially if used during non-windy periods to minimize loss to evaporation. For certain crops, the most efficient irrigation employs a buried or surface drip system, which eliminates evaporation, runoff, and deep percolation. Using a timer to schedule exact water applications can offer some of the best efficiencies. Irrigation specialist Gary Peixoto reports that “an automatic timer can be set late in the evening when the time of use costs much less to run a pump. That is money savings, and is ecologically friendly because less power has to be generated to keep up with demand.”

Collecting water at the bottom of fields in tailwater ponds can achieve water savings and at the same time serve as a sediment catchment basin and a refuge for wildlife. Jim Marshall, Manager of Suncrest Nursery, asserts, “We are saving half of all the water used in our nursery, now that we have installed valves activated by a central computer for timing our irrigations, and collected tailwater in ponds for re-use, via a system of drains. The additional recovery of fertilizer in the water means we don't have to fertilize as much.” Planted with native species these ponds provide habitat for amphibians, birds, and mammals.

Estimated Annual World Water Use



World water supply and demand have risen steadily, tripling since 1950 (after Postel, 1992).

Vibrant Crops and Land Ethics

The healthiest crops will be watered the most efficiently, without water-logged, disease-ridden soil; salinity build-up; nitrogen leaching past the root zone; or erosion of vital topsoil. Water conservation will boost yields, save money from reduced water and pumping costs, and ultimately save groundwater supplies and the ecological integrity of rivers, streams, and wetlands. Healthy freshwater ecosystems can result from each person in the community practicing the conservation land ethic Aldo Leopold promoted more than 50 years ago:

A land ethic, then, reflects the existence of an ecological conscience, and this in turn reflects a conviction of individual responsibility for the health of the land. Health is the capacity of the land for self-renewal. Conservation is our effort to understand and preserve this capacity.

—Aldo Leopold, *A Sand County Almanac*

Making Each Drop Count in the Community

Since the average person in the United States uses up to 120 gallons of water per day, everyone can adopt conservation measures that help to save freshwater supplies. Below are a few strategies that make every drop count.

- ❖ **Drought Efficient Landscaping** around the home can produce a yard easy to design and maintain. Once established, native plants do not need water as frequently and usually will survive a dry period without watering.
- ❖ **Micro and Drip Irrigation and Soaker Hoses**, examples of the most efficient irrigation devices, will make watering easier.
- ❖ **Garden Sprinklers and Hoses** should be closely attended. A garden hose can pour out 600 gallons or more in only a few hours.
- ❖ **Mulch** retains moisture in the soil and helps control weeds that compete with landscape and garden food plants for water.
- ❖ **Organic, Slow-Release Fertilizers** can match the plant's needs.
- ❖ **Spare Use of Pesticides** will reduce the incidence of pollution. Most U.S. urban waterways tested by USGS contain over-the-counter pesticides.
- ❖ **Schools and Local Governments** can help to promote a water conservation ethic among children and adults.



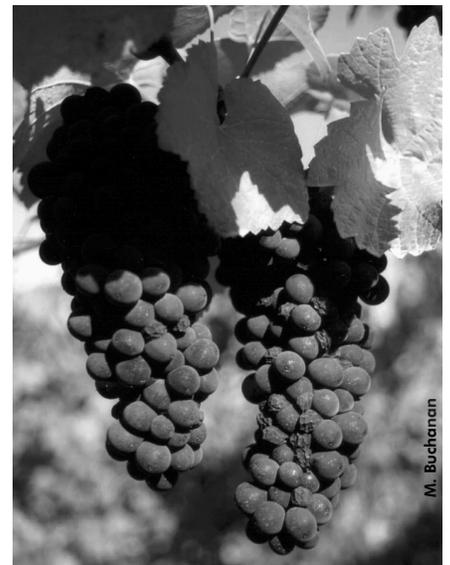
Buchanan Family Century Farm

Nestled between Oregon's Coast Range and the Willamette Valley, at the confluence of two meandering creeks, the Buchanan Family Century Farm is accustomed to the influence of water. In fact, during the rainy season almost half of the farm disappears under water. As the rains come, the streams rise, overflowing across the wide floodplain of native wetlands and woodlands.

Over five generations, the Buchanans have left natural processes uninterrupted and preserved wildlife habitat. To date, the farm boasts more than 230 acres of land protected under a Wetland Reserve Program with ponds and habitat for migratory waterfowl, beaver, frogs, turtles, native trout, skunk, coyote, fox, deer, elk, and nearly 100 species of birds. The Buchanans have expanded riparian borders with native plants and maintained natural hedges along fence lines and field borders.

Commodities grown and raised at the farm include sheep, hazelnuts, grass seed, wheat, hay pasture, and wine grapes. These crops are farmed with water from natural rainfall, requiring no additional irrigation, which reduces runoff, erosion, and potential impacts to wildlife. The vineyard, with its perennial cover crop and intact riparian buffer, is certified as Salmon-Safe under an ecolabel. The Buchanan farm also operates Tye Wine Cellars, a small winery open to the public on weekends. Visitors come for wine tasting, hiking, and picnicking, and to enjoy Tye's concerts, community fundraisers, and special events.

For information about Buchanan Family Century Farm and Tye Wine Cellars, please contact the Buchanans at 26335 Greenberry Road, Corvallis, Oregon 97333; 541-753-8754; or visit www.tyewine.com.



Global Water Pressure

- ❖ Less than 2.5% of all the water on the planet exists in freshwater systems, and most of it is tied up in ice-caps and glaciers or exists as groundwater too deep to tap economically.
- ❖ One-quarter of 1% of freshwater is available and sustains a disproportionately large number of the world's species.
- ❖ Per capita use of water doubles every 20 years.
- ❖ 2.7 billion people will face severe water shortages by 2050 if consumption continues at current rates.
- ❖ 31 countries and more than a billion people lack access to clean water.
- ❖ 2.5 billion people lack proper toilets or sewage systems.
- ❖ More than 5 million people die each year from water-related diseases such as cholera and dysentery.
- ❖ 20% of agricultural land worldwide is irrigated.
- ❖ About 60% of global agricultural irrigations are inefficient.
- ❖ 35–40% of agricultural harvest comes from irrigated land.
- ❖ About 20% of the world's irrigated farmlands are damaged by salinization.
- ❖ Roughly half of groundwater supplies and coastal wells in India are severely threatened by overpumping and saltwater intrusion.
- ❖ More than 45,000 dams catch 14% of all precipitation runoff.
- ❖ Between 40 and 80 million people have been displaced from the freshwater ecosystems they depend on because of dam construction.
- ❖ Only 40% of the world's largest 227 rivers still run free.
- ❖ The Aral Sea in Central Asia has shrunk by half because of water diversions for cotton and other crops.
- ❖ Almost 500,000 of the world's waterways have been altered for navigation purposes with a consequent decline in their viability as habitat.
- ❖ Roughly one-third of the freshwater fish species globally are threatened with extinction.
- ❖ The World Commission on Water predicts future water uses will cause "intolerable stresses on the environment, leading not only to a loss of biodiversity, but also to a vicious circle in which the stresses on the ecosystem no longer provide the services for plants and people."

Our relationship with food was once, and arguably should always remain, one of our deepest connections with the biotic community, for it ultimately determines what kinds of fellow beings we are. At this crossroads early in the 21st century, we face a revolution of no small proportions in how our food and fiber will be produced and at what economic, social, and biological costs. Our society will determine, through policies and purchasing habits, through personal and communal commitments, what kinds of landscapes we support and what species remain on them.

—Daniel Imhoff, *Farming with the Wild*

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