IMPACTS OF ECOSYSTEM SERVICES ON LONGTERM COMMUNITY HEALTH

Between 2019 and 2020, the University of Arizona Water Resources Research Center (UA WRRC) will complete an **ecosystem services** (ES) assessment of the Globe-Miami area. Focused on the Pinal Creek sub watershed (Cobre Valley), the assessment will be organized into different stages:

1. Literature review to identify methods, case studies, trends, and ecosystem services of value to the region.
2. Interviews with local and regional expert stakeholders and review results with a working group to evaluate the project's approach.
3. Demonstration of ES impacts on the region through qualitative (social value) and quantitative (calculated values) calculations displayed in a series of maps and results that will feed into future scenarios exploring the future in the Globe-Miami area.

This quick introduction to **ecosystem services** has been created as a public resource and simple overview of the natural environment's value to the social and economic context of Cobre Valley.

WHAT ARE ECOSYSTEM SERVICES (ES)

Our natural environment freely provides us with countless services. Recently there has been a push among researchers and natural resources managers to consider these services while generating water and land use plans. Before plans are drafted, it is helpful to understand exactly what values are important to your community by quantifying or assessing the services, value, and vulnerability or threat to those services, as well as mitigation to keep those services intact.

***Ecosystem services** (ES) describe the direct and indirect benefits obtained by humans from their ecosystems.*

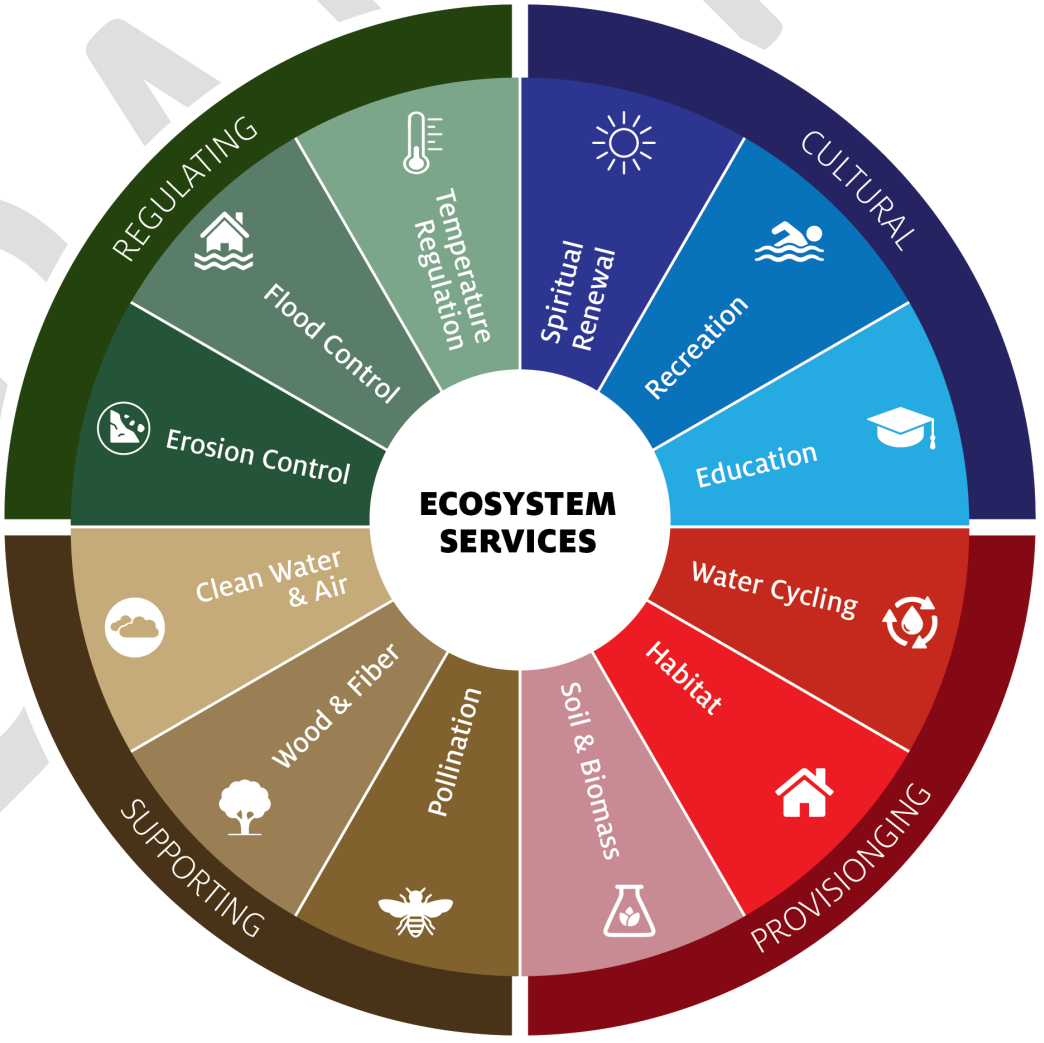

Figure 1: Classifying ecosystem services into categories is one way of understanding what services are the most beneficial, vulnerable, or impacted in Cobre Valley.

ES benefits are as wide ranging as imaginable. They include tangible products such as firewood and tourism. However, ES benefits are

often less tangible, but no less important, in providing services that affect and improve daily life such as micro-climate control, erosion control, and water purification – services that would otherwise require expensive infrastructure projects, maintenance, and planning. Planning to maintain and restore ecosystem services ensures long term benefits – both tangible and intangible.

Research estimates the mean global **ecosystem service value (ESV)** in 2015 to be $57.76 trillion, which is down $1.21 trillion from 1995's mean **ESV** of $58.97 due to depletion of forest cover and wetland/water surface (Sannigrahi 2018). To put that in perspective, the United States, which represents the largest economy in the world generated $18 trillion in 2015 across all of its good and services (World Bank).

HOW TO EVALUATE ECOSYSTEM SERVICES

*Humans are dependent on **ecosystem services**.*

Despite the relatively small footprint of urban areas (<3 % of the global land surface), there is increasing recognition that urban ecosystems and their services have a disproportionate importance due to their proximity to human activity and occupancy (Grimm et al. 2008).

While preserving our natural environment can sometimes be seen as conflicting with economic growth, there are more and more ways for markets to value natural resources.

- Valuing nature is central to mainstreaming conservation, but is not an end in itself
- A better understanding of ecosystem production functions is necessary to integrate research into the development of new policies and institutions
- The Natural Capital Project is designing practical tools for this purpose, including InVEST, a system for quantifying ecosystem services produced under different scenarios
- The use of these tools in contrasting settings is opening up important conservation opportunities

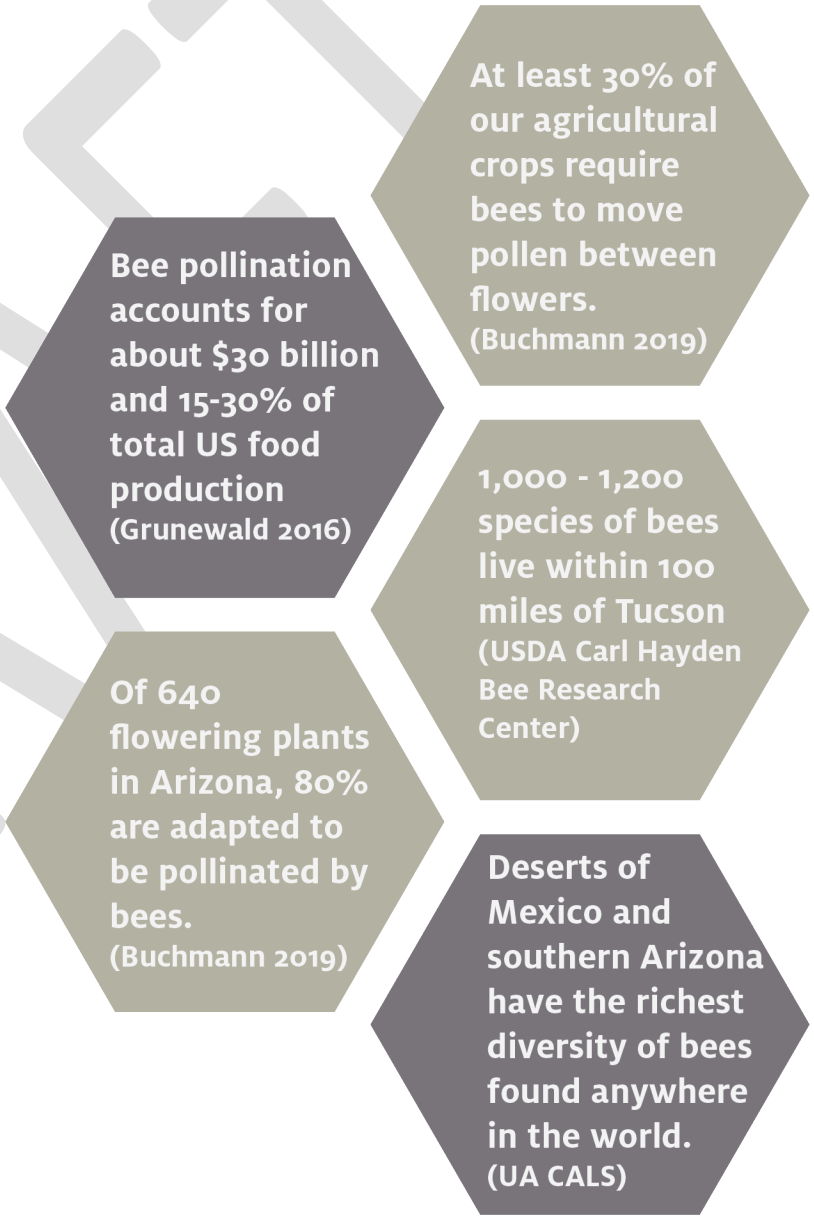

Figure 2: Ecosystem services, such as pollination, are dependent on functioning natural systems and are vulnerable to stressors such as drought and declining precipitation.

UA WRRC is considering several methods and research recommendations.

After the emergence of **ecosystem services** as a concept in the 1990s, various frameworks were developed to attempt to systematize this new knowledge and to guide policy and decision-making practices.

❖ Relevant Frameworks to Understand, Analyze, and Measure ES

The following analytic frameworks are useful to increase the understanding of natural capital and ecosystem services, and their linkage to human well-being:

- **Millennium Ecosystem Assessment (MA):** First major international effort to explore **the linkages between ecosystem services and human well-being**
  - Widely accepted amongst scientific and policy communities
  - Designed to understand the current state of major ecosystem services, trends in their production and flows, as well as major pressures and threats, management decisions and policy formulations
- **Economics of Ecosystems and Biodiversity (TEEB):** Combines both ecological and economic perspectives in a collaborative way, so any trade-offs are better understood at policy and decision-making levels
  - Intends to inform conventional economic policy about its impact on ecosystem health and biodiversity
  - Emerged in response to the lack of economic perspective of biodiversity loss and ecosystem degradation in the MA framework
  - Emphasizes **more joint efforts of ecologists and economists** in **ecosystem services valuation**

It is important to note that current established frameworks are exclusively focused on assessing ecosystem services at regional and global levels. Any valuation of ES cannot be relevant without integrating locally relevant data and knowledge.

❖ Current Approaches to Valuating Ecosystem Services

Within analytic frameworks there also exists different eco-system valuation approaches, outlined below:

Data vs. simulation-based approaches

- Data and information are vital for understanding and quantifying ecosystem services and how their functioning can create services for human well-being
- Simulation (i.e. the estimation of environmental variables through computer-based modeling) can help with quantifying ES where direct observations are scarce or absent

Monetary approaches

- Direct influence in policy and decision making due to easily comprehensible metrics linking ES to human wellness
- Accounts for impacts and side effects so that they can be used for decision making processes
- Deficient in capturing the actual values of ecosystem services for decision making

Economic valuation of ES

- Divided into use and non-use values: 1) use values support people's own consumption (e.g. clean water and eco-tourism); 2) non-use values result from the regulatory or supporting ecological processes that contribute to the ecosystem services giving rise to benefits that provide intangible human benefits (e.g. improved tree canopy can lead to increased water availability in downstream areas)

Benefit transfer valuation (BTV)

- Widely used method of ES measurement due to its simplicity and feasibility - BTV measures the economic value of a specific ecosystem service from one or more case sites, and applies that value to a new site with comparable ecosystem function

❖ Applying Real Life Scenarios and Valuations

With any monetary valuation method, economic values are estimated based on either market transaction values of intended ecosystem services or in absence of such values, with the help of some kind of parallel market transactions that are associated indirectly with the ecosystem services to be valued or value estimation based on consumers' willingness to pay for the ecosystem services goods and services. Simply put, is anyone willing to pay for the preservation of ES or to avoid the loss of ES? If so, how much and how would they assign a reasonable price?

There is increased awareness among business communities around the world that scarcity of natural resources, reduced biodiversity, and the degradation of ES not only pose a growing level of risk for companies, investors, banks, and insurance companies, but also that solving these problems may open up opportunities of great financial significance.

Figure 3: Risks to Businesses from the Degradation of Ecosystem Services

ECOLOGICAL RISKS

- Risks related to biodiversity-related ecological impacts and dependencies, linked to biodiversity loss/ecosystem degradation
- Primarily operational risks associated with resource dependency, scarcity, and quality
- Some risks linked to increased raw material and resource cost (e.g. fresh water)

LIABILITY RISKS

- Increases in environmental regulations require transparency of companies and biodiversity/environmental impact assessments, which is leading to more local and site-level disputes and expenses

With the help of stakeholders and local experts, UA WRRC will evaluate the impact of ecosystem services on the community health and economy of Cobre Valley, taking into consideration the many and varied benefits derived from the natural environment. Looking into the future, how might these benefits be diminished or affected by drought? How might local decisions and industry support help increase the resilience of these resources? Over the next two years, we will work with community members and the Cobre Valley Watershed Partnership to develop in-depth answers to these difficult questions.

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