



## Explain, Lesson #5: "Services that Stick"

These materials are all part of EPA Report #: EPA/600/R-18/231.

### Time Consideration

Prep time: 10-15 minutes, Activity time: 30+ minutes

### Materials

Printed handouts: (a) **Ecosystem Blank Templates**, (b) **Ecosystem Services Puzzle Pieces**, (c) **Connections to Human Health Sheets**, scissors, crayons, and glue for each group

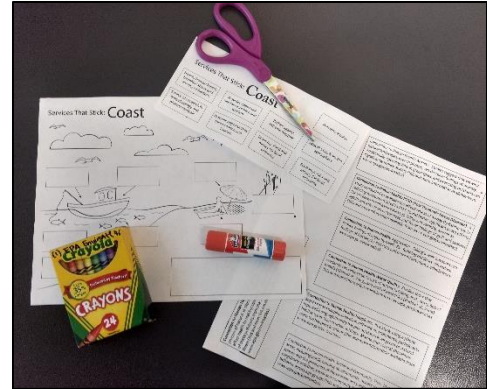


Figure 1. Set of "Services that Stick" materials for one ecosystem group (Coast). 3 handouts, scissors, glue, & crayons.

### Teacher Preparation

1. **Print all of the following:**
  - **Ecosystem Blank Templates** (there are 7 unique ecosystem templates). Having the students work in groups of three is recommended, so if you have 21 students, you'll need only one complete set of Ecosystem Blank Templates per class.
  - **Ecosystem Services Puzzle Pieces**. Again, there are 7 unique sets of ecosystem services puzzle pieces. Each group should receive one Ecosystem Blank Template and one matching set of Ecosystem Services Puzzle Pieces (i.e., the group that receives the "Coast" Ecosystem Blank Template should also receive the "Coast" set of Ecosystem Services Puzzle Pieces).
  - **Connections to Human Health Sheets**. You can adapt this as you see fit; it is recommended that you give each group of students **all of the** Connections to Human Health pieces and *make the students select* which human health outcome is the best fit for their ecosystem. Therefore, you would need one Connections to Human Health Sheet per group.
2. Distribute all necessary materials for each group: glue, scissors, crayons, and three total sheets of paper per group (Figure 1).



## Procedure

1. Deliver background information on **ecosystem services: providing the benefits that humans receive from nature**. Have students provide examples of ecosystem services and related human benefits.

*Examples of ecosystem services: trees provide oxygen which we breathe; trees provide shade on the playground (US EPA 2008); wetlands filter water (Vellidis et al., 2003); forests provide places for people to recreate (Kline et al., 2011).*

*Examples of human benefits: reductions in stress and anxiety from spending time at the beach (MacKerron & Mourato 2013); reduced symptoms of post-traumatic stress disorder after spending a weekend fly-fishing by the river (Vella et al., 2013).*

2. **Explain the directions to the students:**

- **Cut out** the Ecosystem Services Puzzle Pieces.
- As a group, **discuss** where in their Ecosystem Blank Template the Ecosystem Services Puzzle Pieces should go. *Note: have the students check with you before gluing anything to the page. There are some pieces that could go in multiple spots.*
- **Lay** puzzle pieces where they should go.
- **Glue** the puzzle pieces to their pages.
- **Look at** the Connections to Human Health Sheet. **Decide** which human health connection works best with your specific ecosystem. **Cut it out**, lay it on the sheet, check it with your teacher, and then **glue it** to the page.
- **Color** their Ecosystem Blank Templates.
- Tell the students to take a few minutes to **prepare** a mini-presentation on their **Ecosystem** and the ecosystem services and health benefits that their ecosystem provides.
- Have students **explain** their **Ecosystems**. As groups finish, tape the papers to the board at the front of the room. *Note: paste them together where the letters meet (A matches with A, etc.). At the end, it should look like the example on the next page, and students should notice that there are multiple ecosystem services that repeat across different ecosystems. Discuss this with the students.*

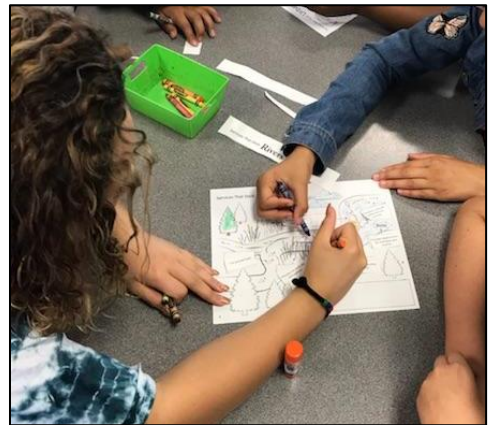


Figure 2. Students color their Ecosystem Blank Template as part of the "Services that Stick" activity.

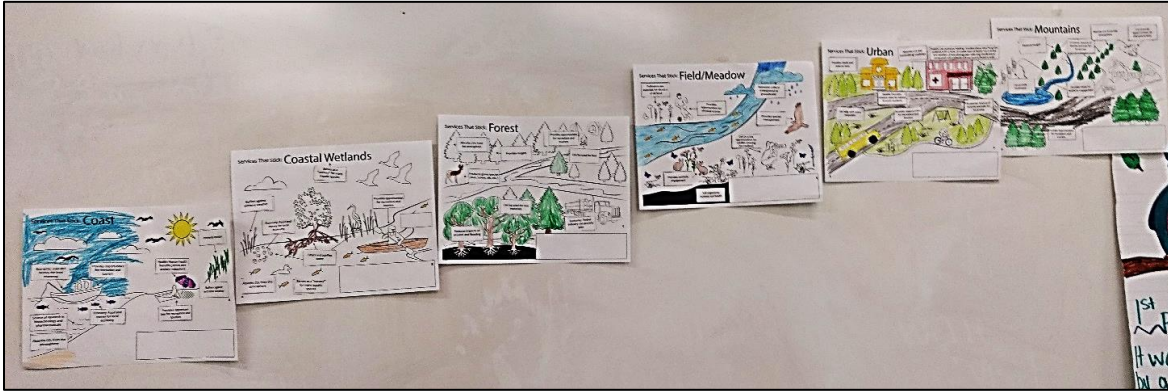
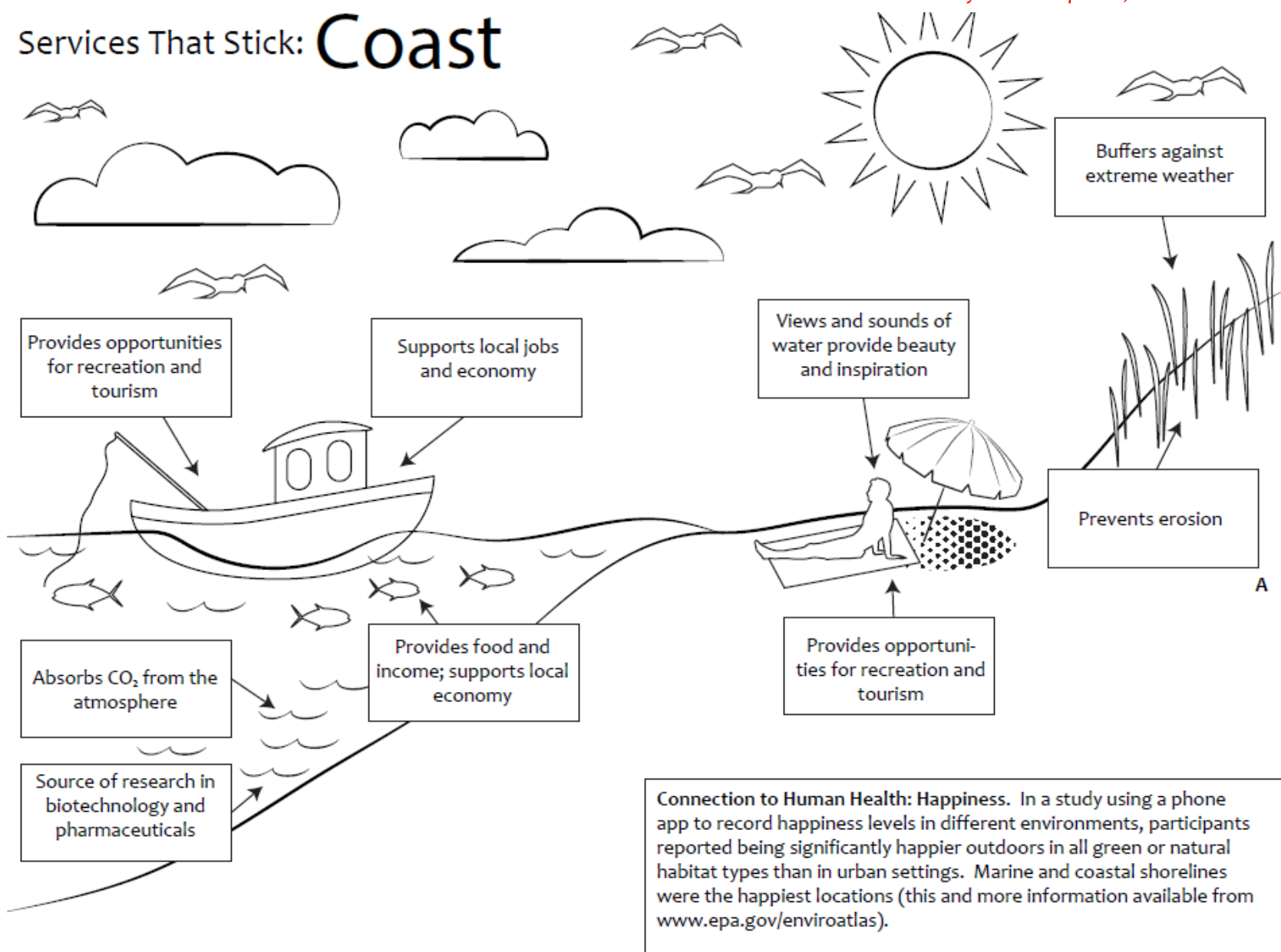


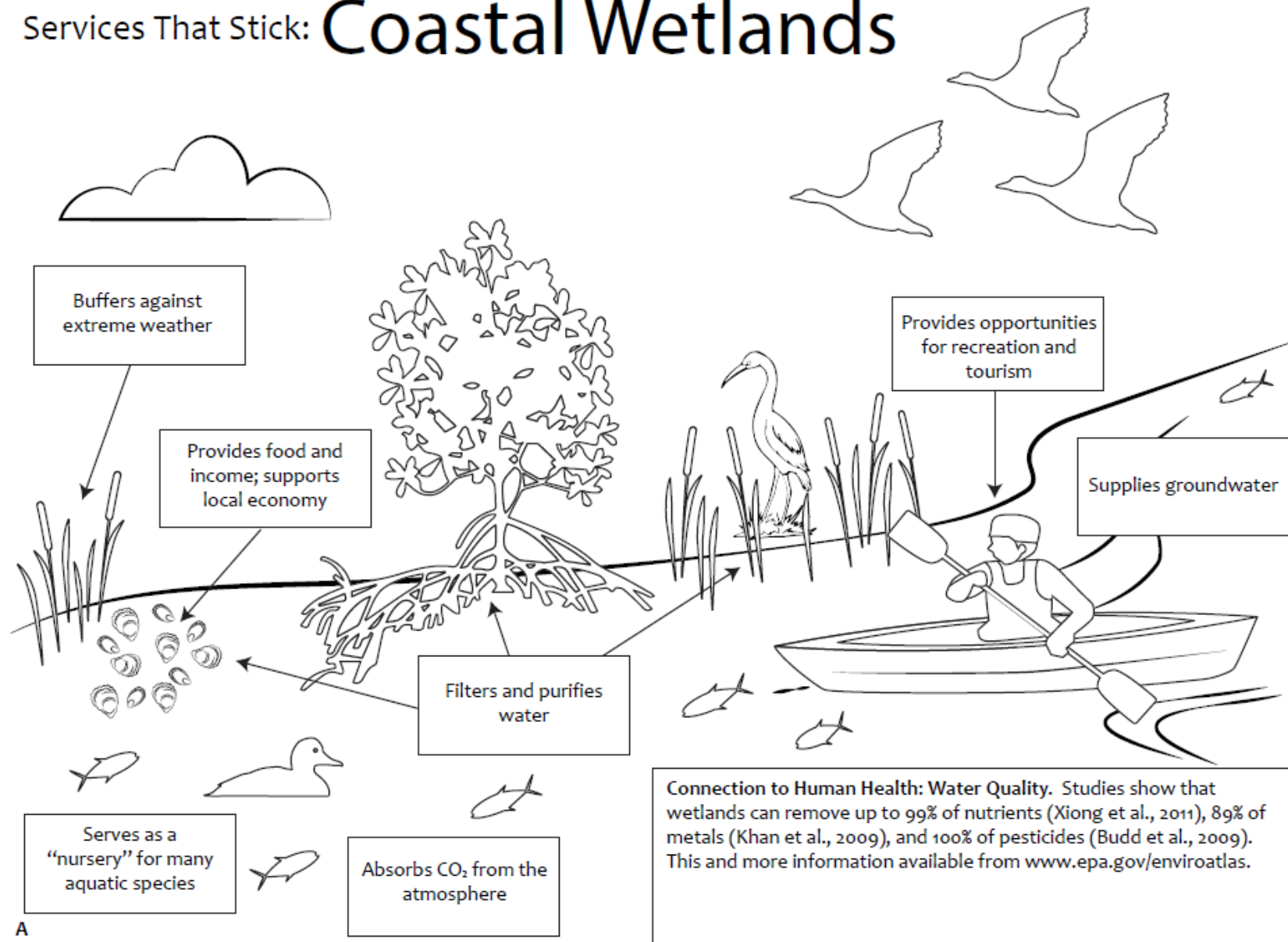
Figure 3. All of the completed ecosystems, when taped together on the board, create a continuous scene.

- Evaluate:** During the group discussions, informally assess student understanding of ecosystem services. Then, have the groups share and **explain** their examples with the whole class. Finally, formally assess student understanding with the collection and reading of the student handouts.

# Services That Stick: Coast



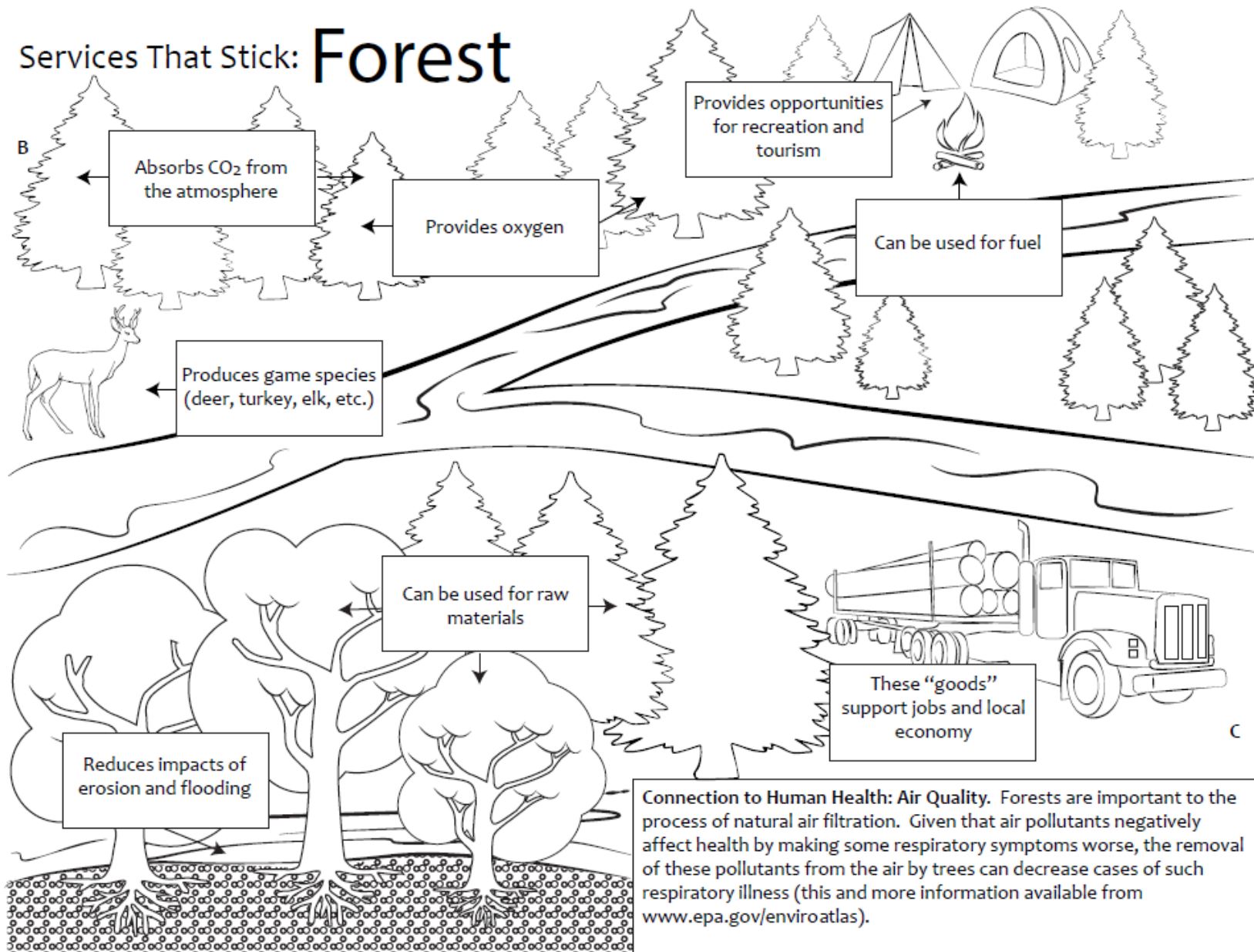
# Services That Stick: Coastal Wetlands



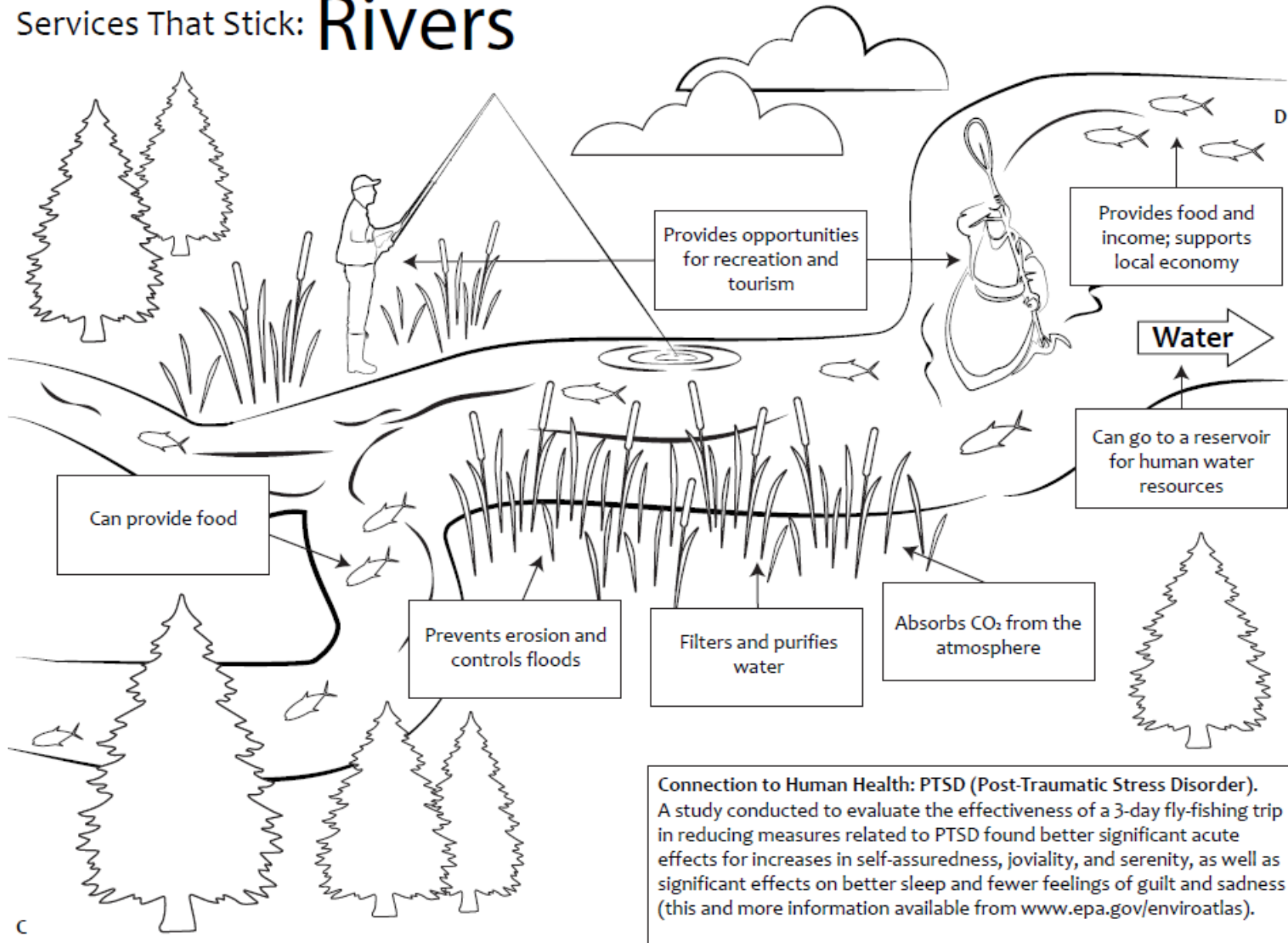
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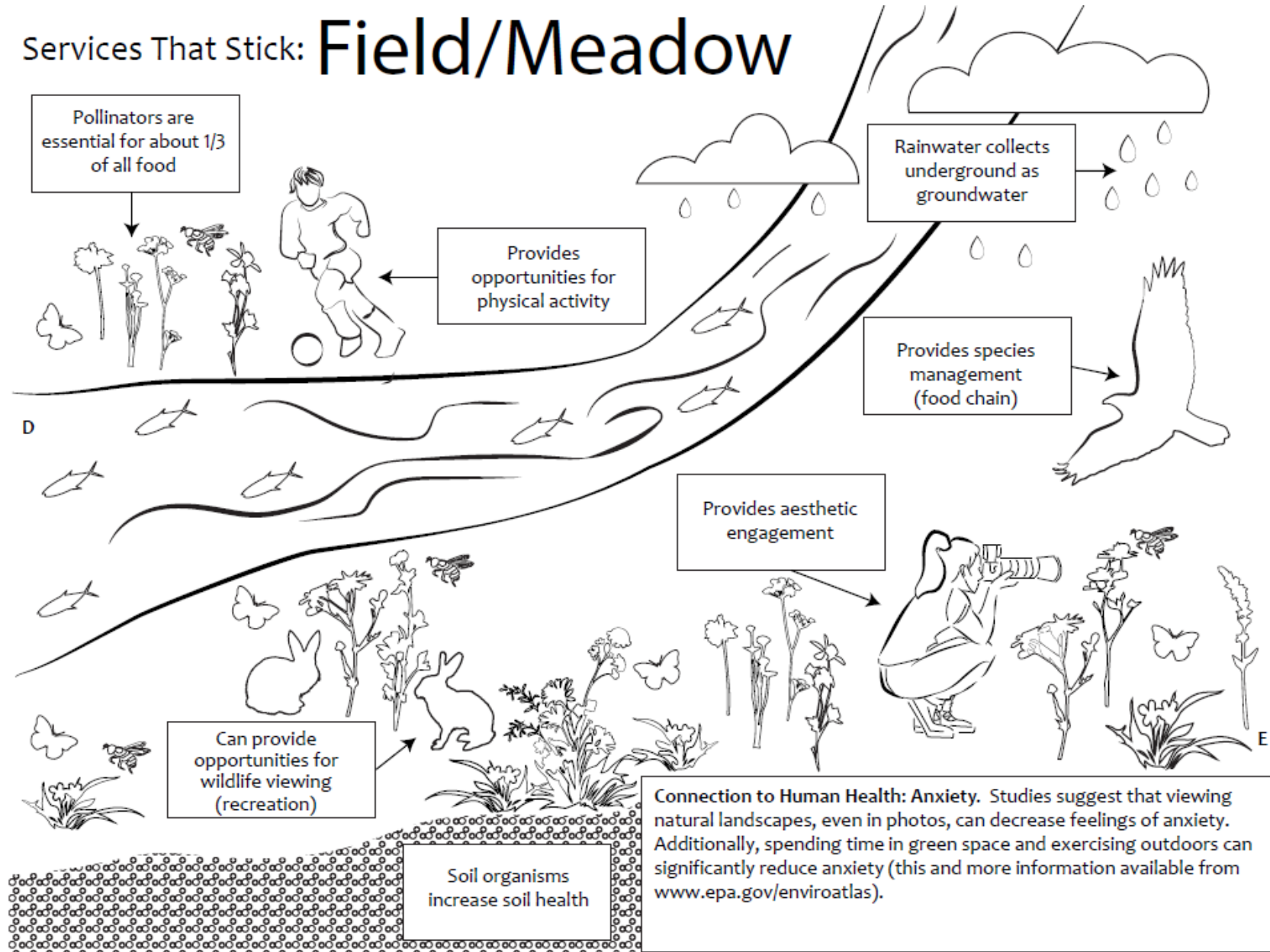
# Services That Stick: Forest



# Services That Stick: Rivers

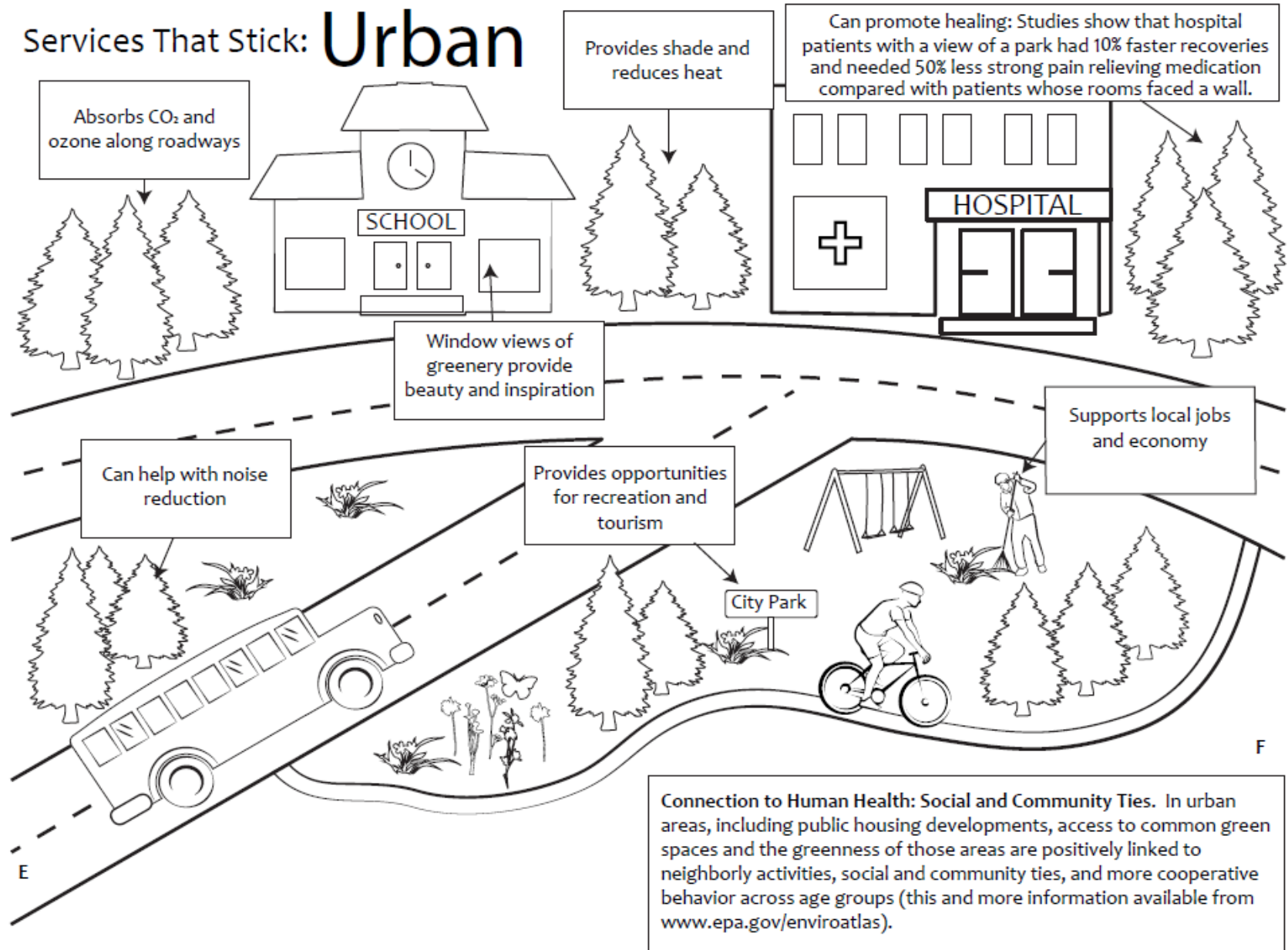


# Services That Stick: Field/Meadow



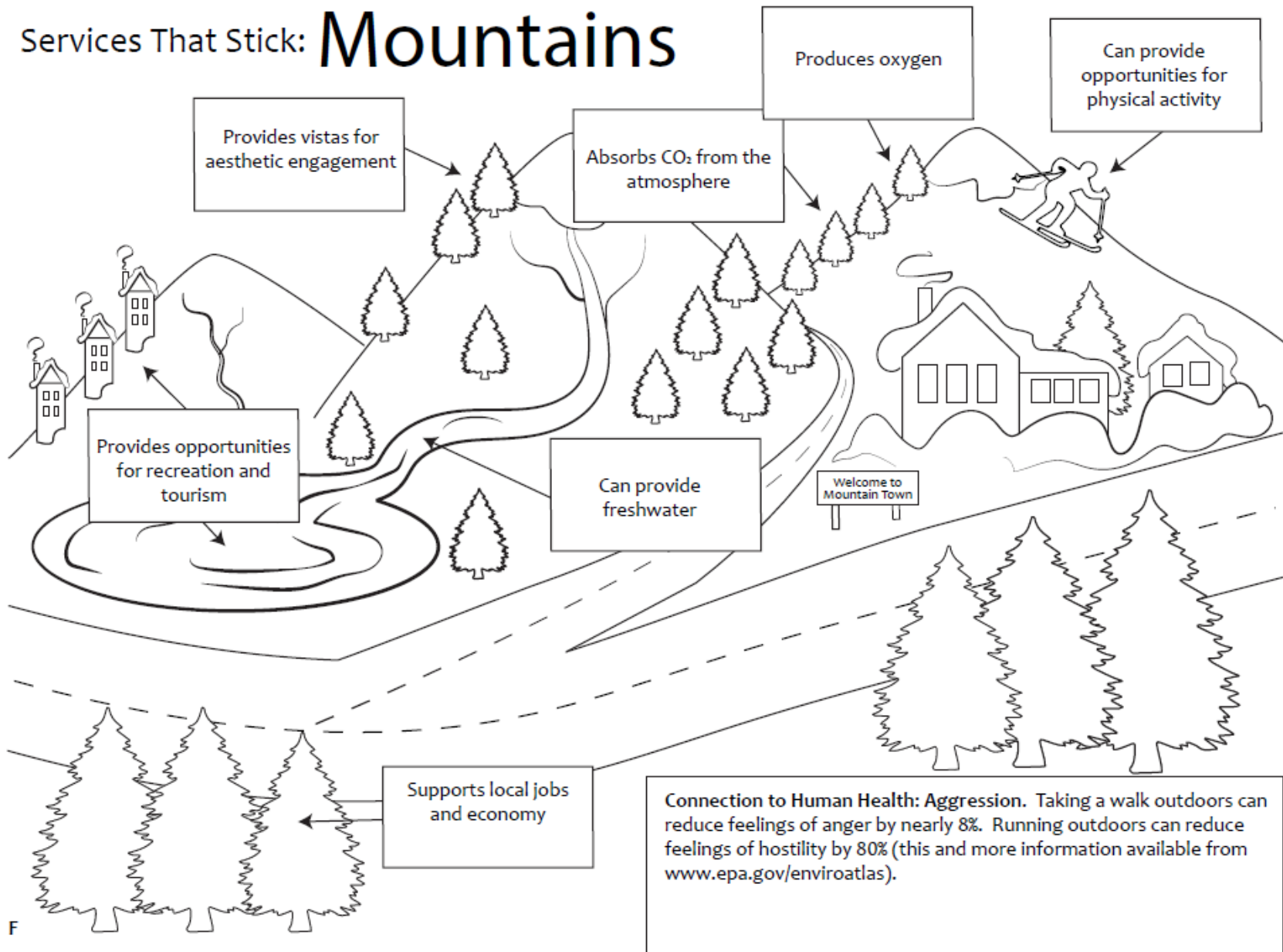


# Services That Stick: Urban



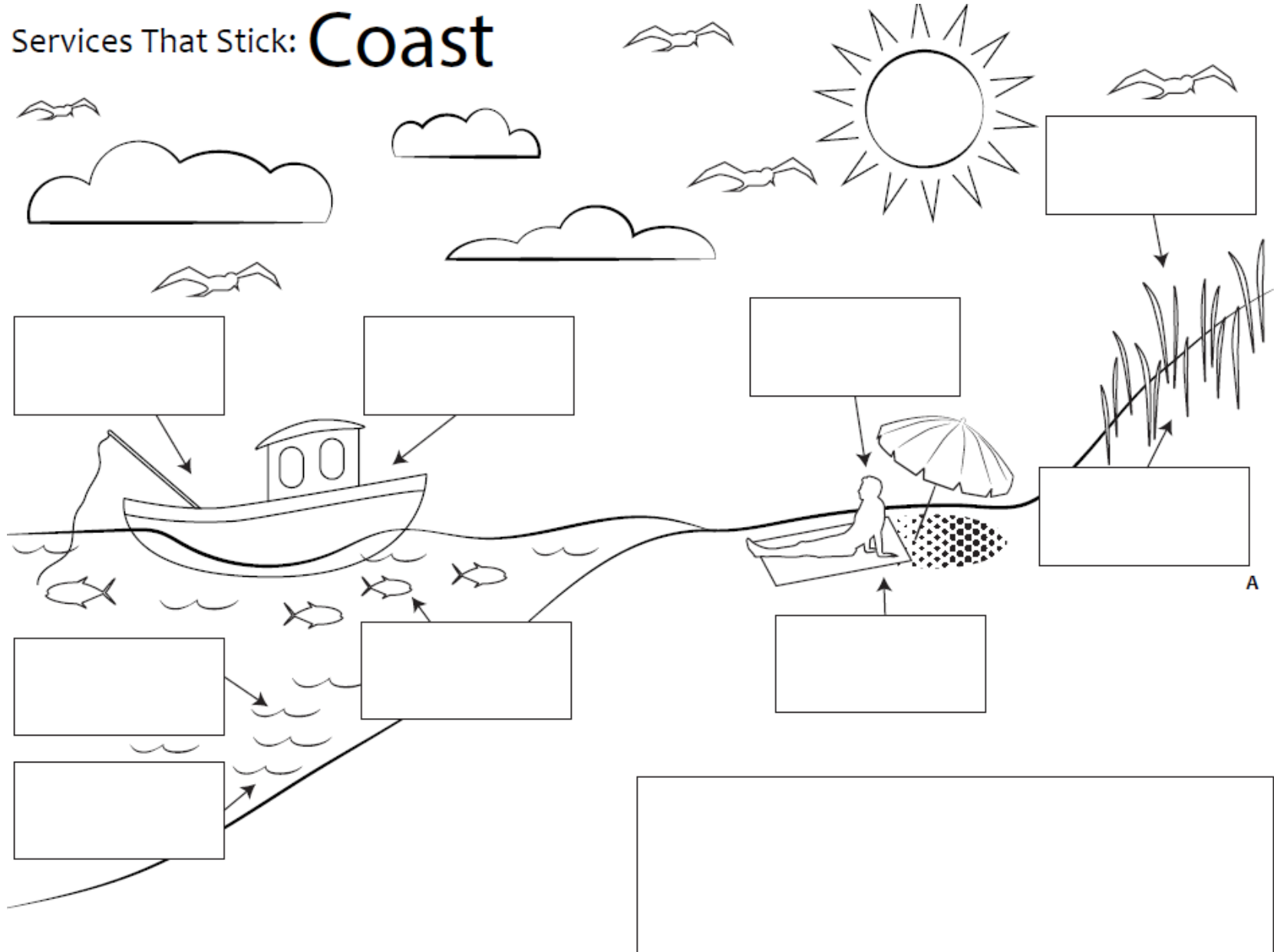


# Services That Stick: Mountains

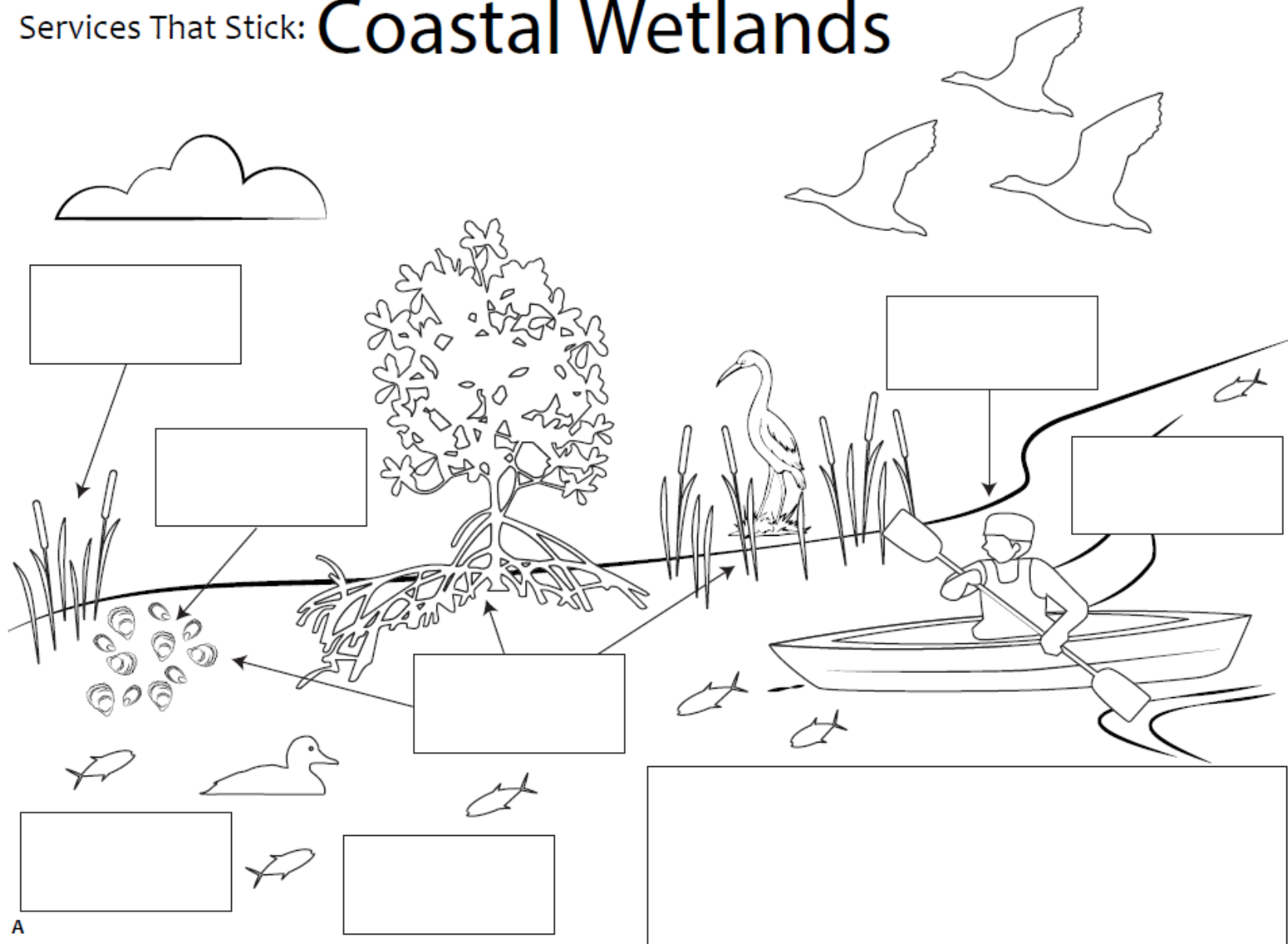


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# Services That Stick: Coast

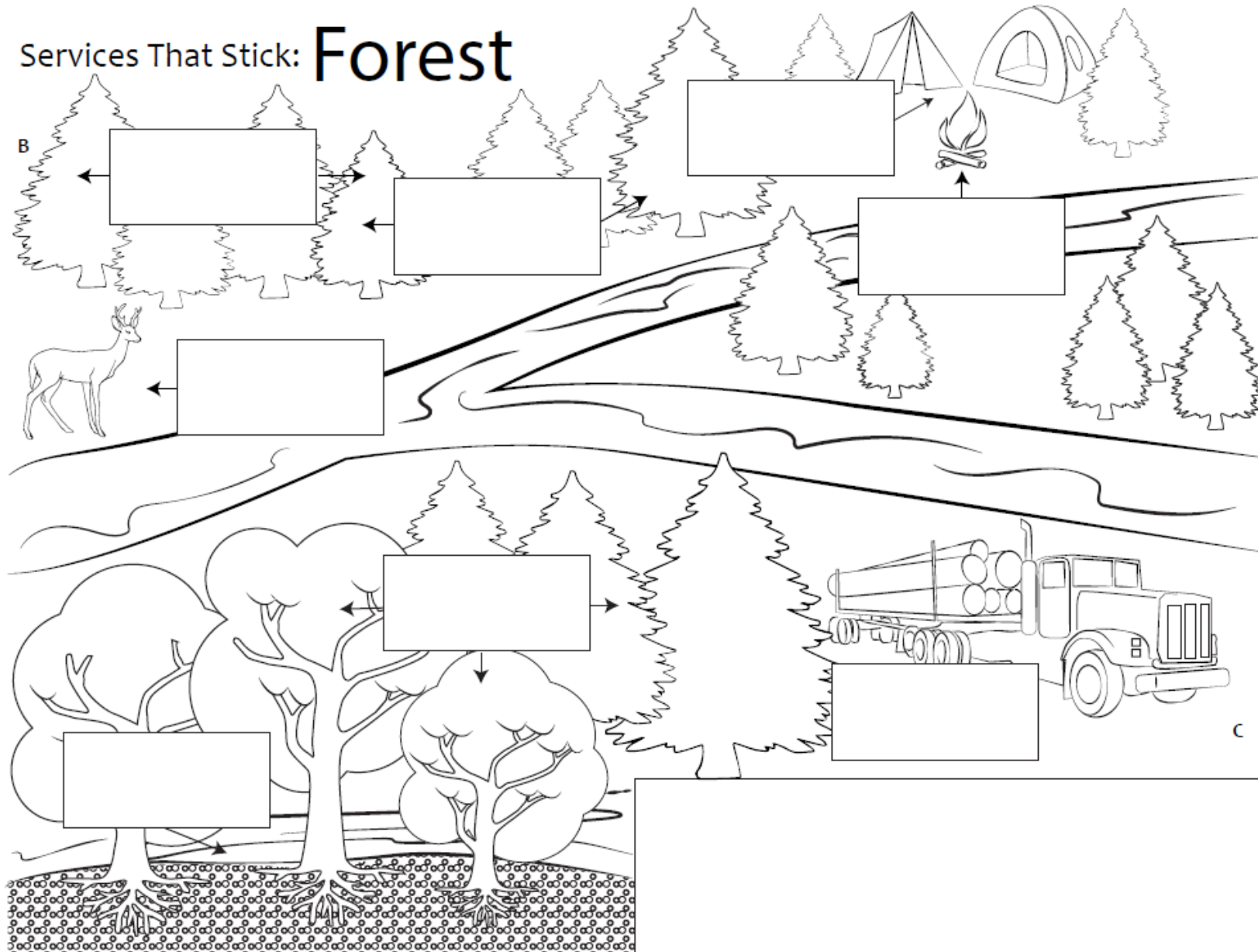


# Services That Stick: Coastal Wetlands

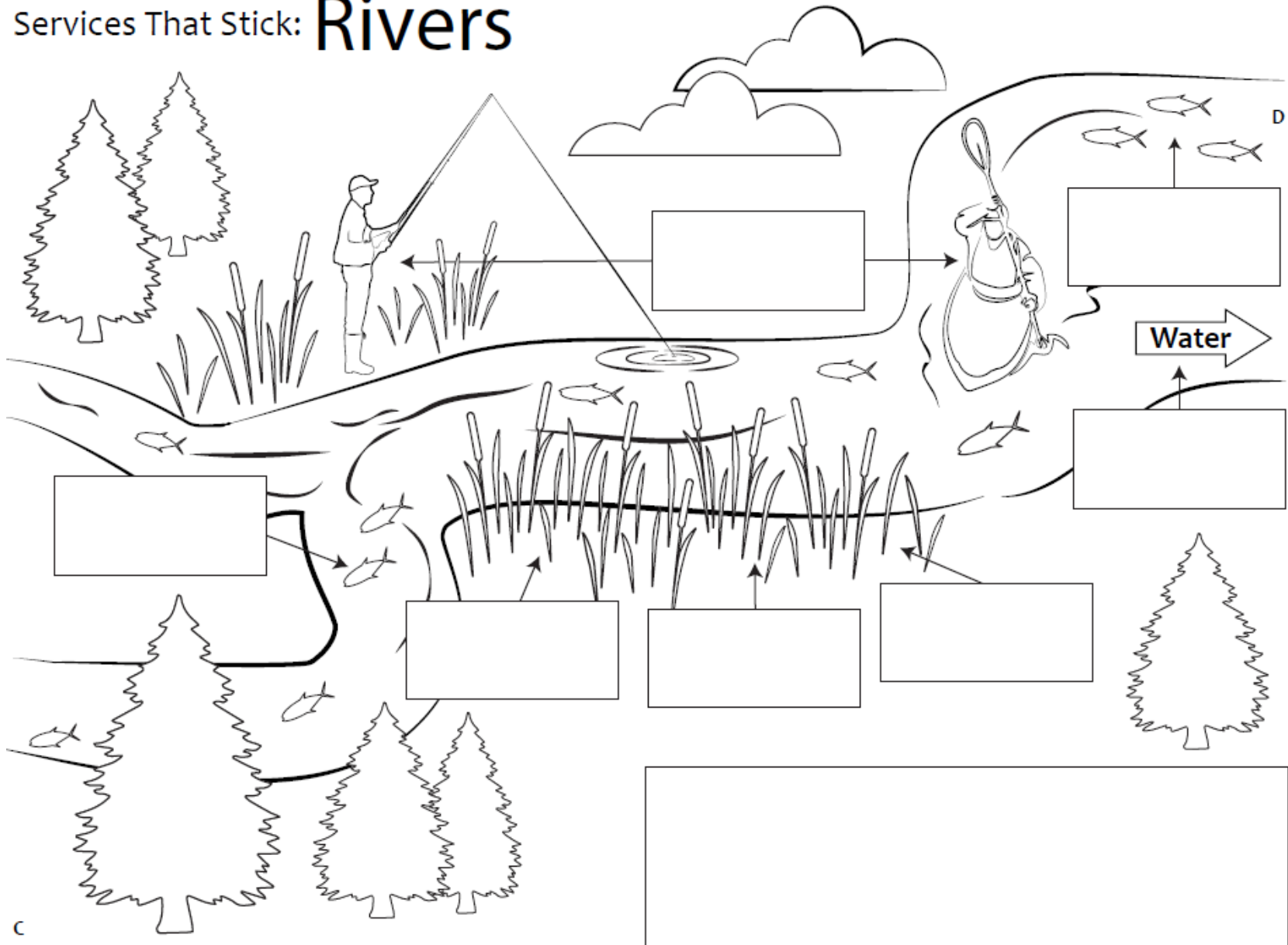


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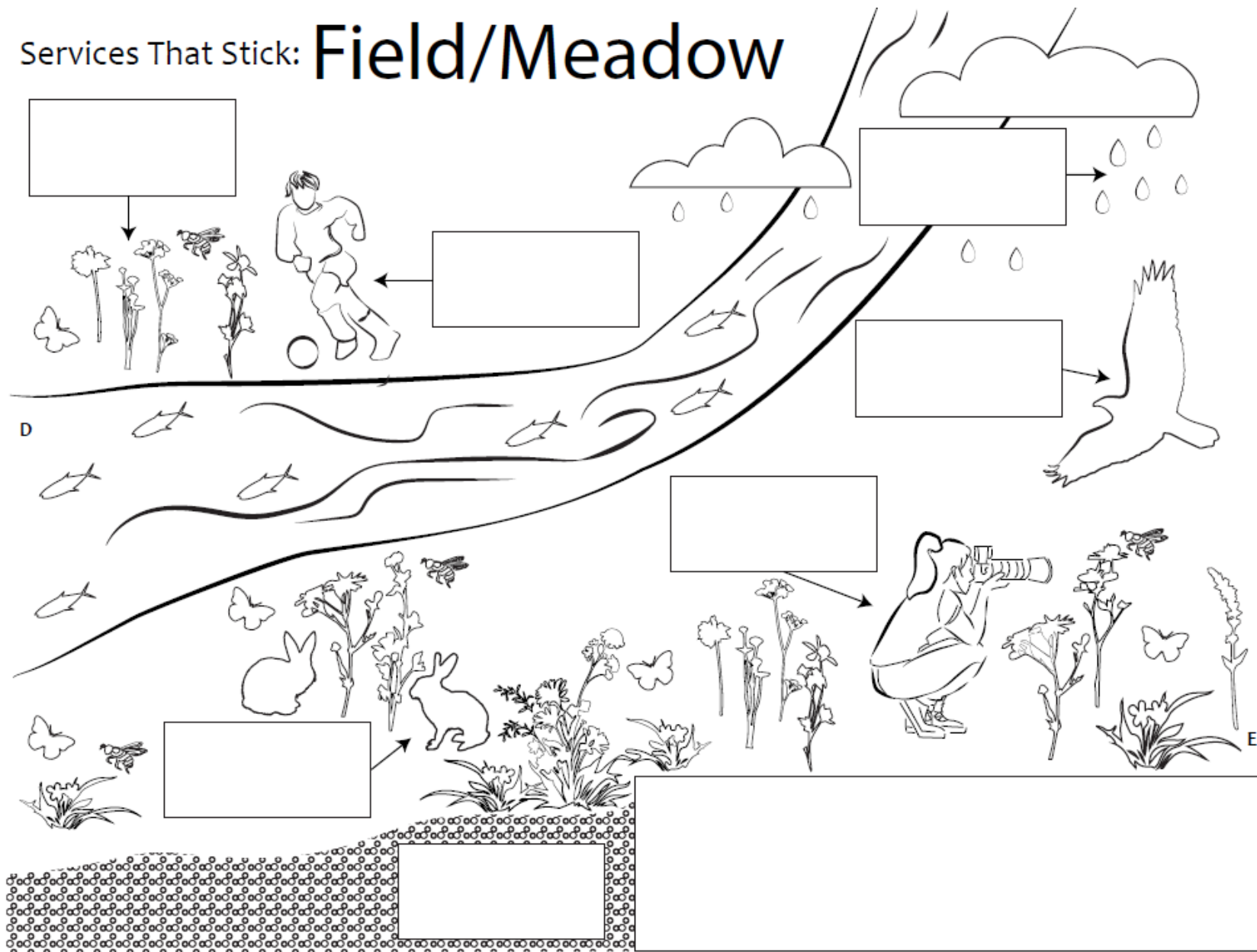
# Services That Stick: Forest



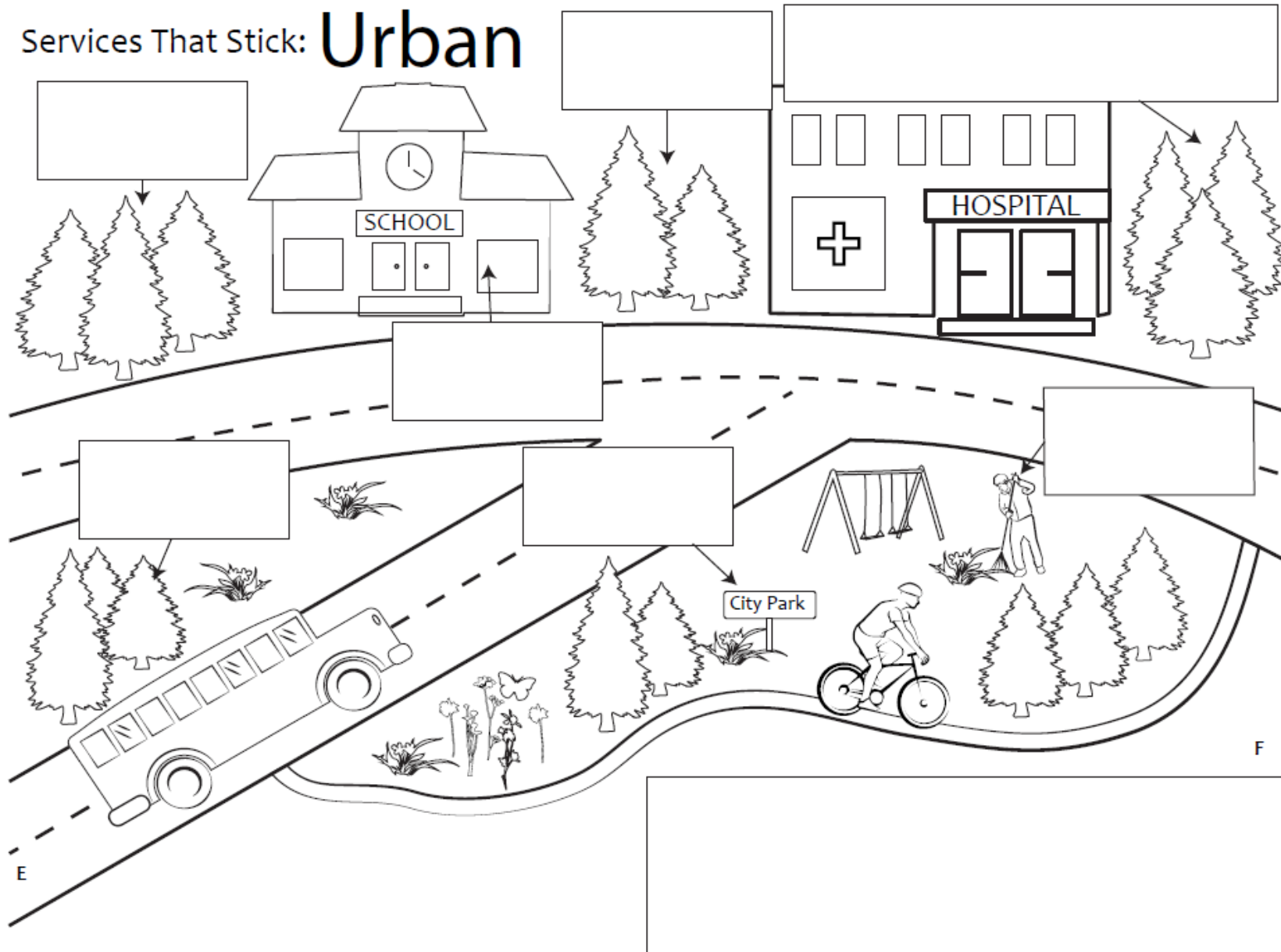
# Services That Stick: Rivers



# Services That Stick: Field/Meadow

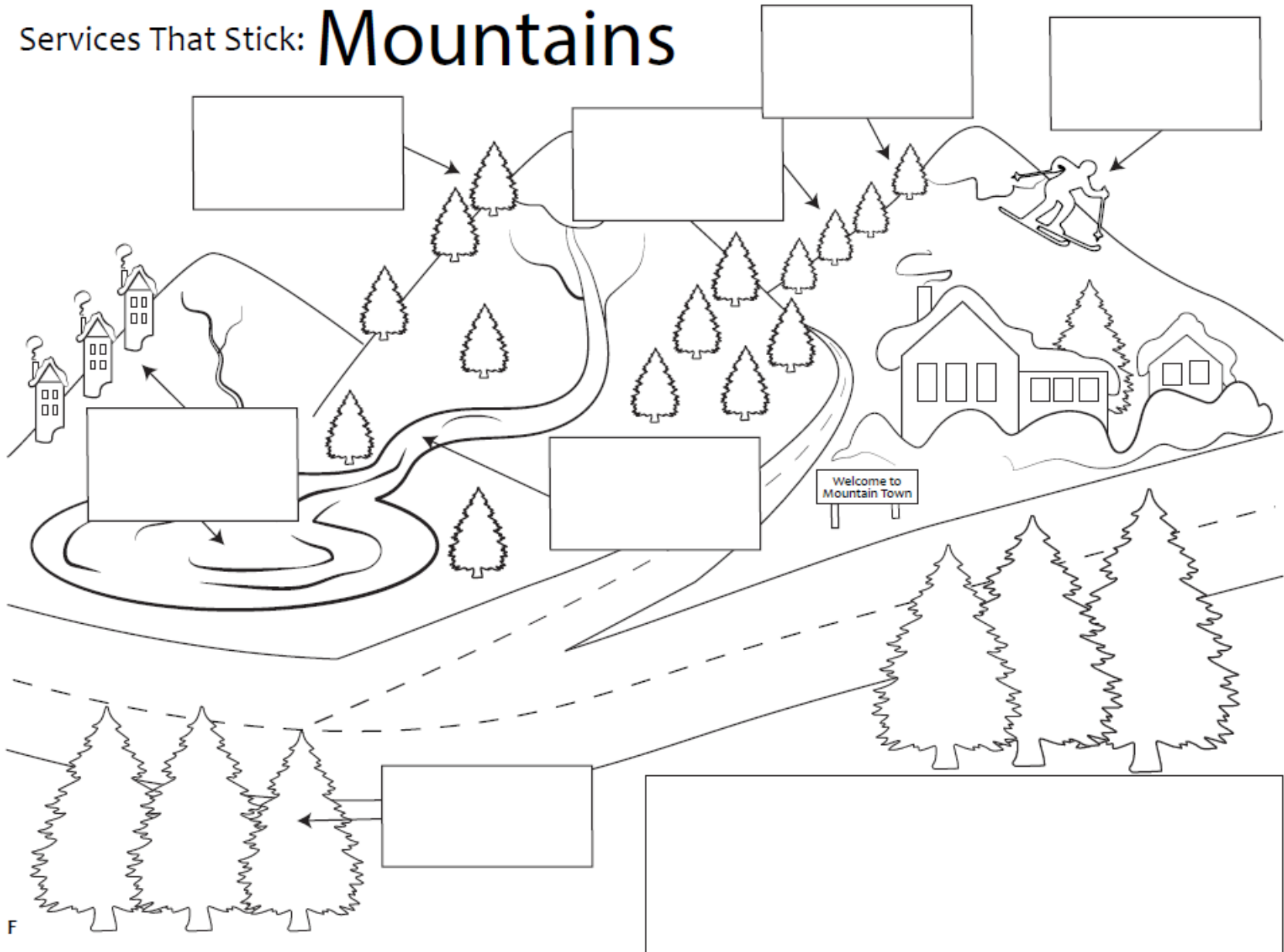


# Services That Stick: Urban





# Services That Stick: Mountains



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**Services that Stick: Coast**

Provides opportunities for recreation and tourism	Buffers against extreme weather	Absorbs CO <sub>2</sub> from the atmosphere	Prevents erosion	Source of research in biotechnology and pharmaceuticals
Views and sounds of water provide beauty and inspiration	Provides opportunities for recreation and tourism	Supports local jobs and economy	Provides food and income; supports local economy	

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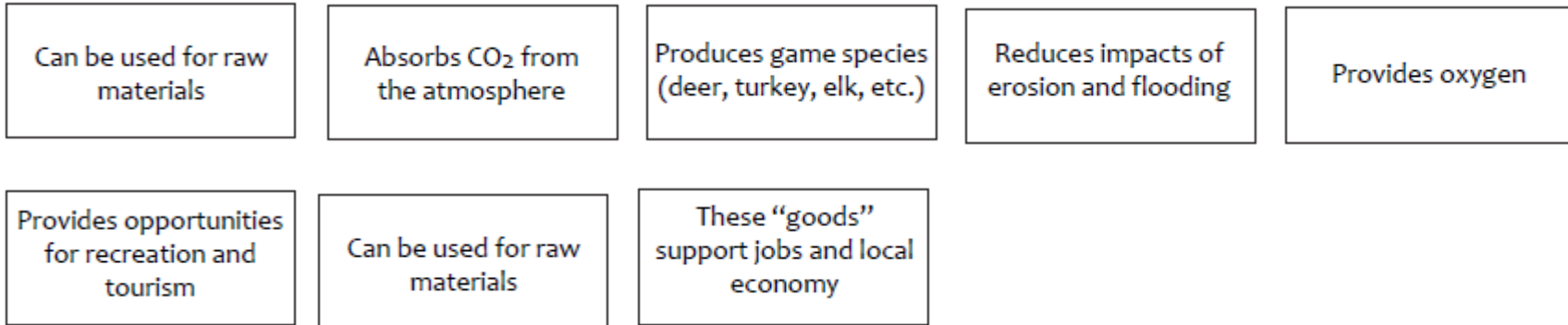
**Services that Stick: Coastal Wetlands**

Buffers against extreme weather	Provides opportunities for recreation and tourism	Provides food and income; supports local economy	Supplies groundwater	Filters and purifies water
Absorbs CO <sub>2</sub> from the atmosphere	Serves as a "nursery" for many aquatic species			

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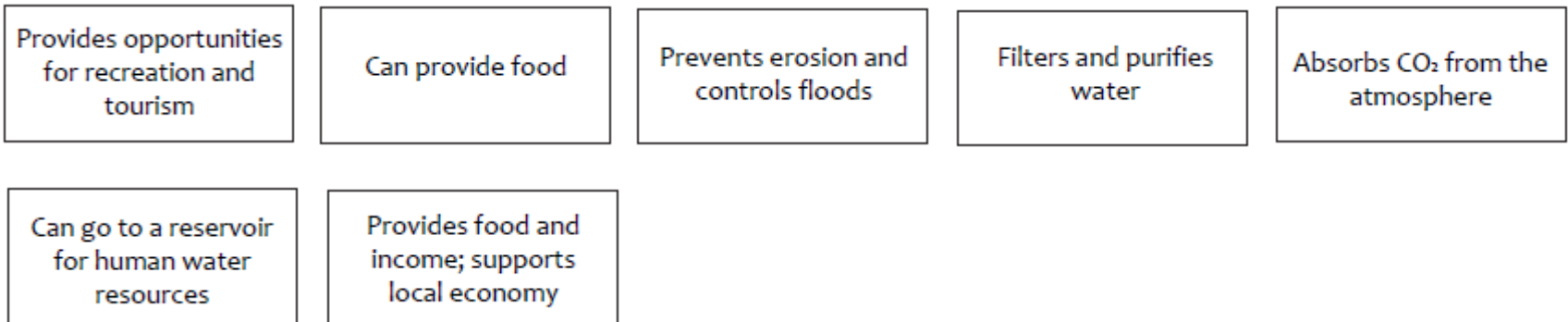
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**Services that Stick: Forest**



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**Services that Stick: Rivers**



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**Services that Stick: Field/Meadow**

Pollinators are essential for about 1/3 of all food	Provides opportunities for physical activity	Can provide opportunities for wildlife viewing (recreation)	Soil organisms increase soil health
Provides species management (food chain)	Provides aesthetic engagement	Rainwater collects underground as groundwater	

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**Services that Stick: Urban**

Absorbs CO <sub>2</sub> and ozone along roadways	Can help with noise reduction	Window views of greenery provide beauty and inspiration	Provides opportunities for recreation and tourism
Provides shade and reduces heat	Supports local jobs and economy	Can promote healing: Studies show that hospital patients with a view of a park had 10% faster recoveries and needed 50% less strong pain relieving medication compared with patients whose rooms faced a wall.	

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Services that Stick: Mountains



**Instructions:** Choose the best example below that best matches your *Ecosystem Blank Template*.

**Connection to Human Health: Aggression.** Taking a walk outdoors can reduce feelings of anger by nearly 8%. Running outdoors can reduce feelings of hostility by 80% (this and more information available from [www.epa.gov/enviroatlas](http://www.epa.gov/enviroatlas)).

**Connection to Human Health: Anxiety.** Studies suggest that viewing natural landscapes, even in photos, can decrease feelings of anxiety. Additionally, spending time in green space and exercising outdoors can significantly reduce anxiety (this and more information available from [www.epa.gov/enviroatlas](http://www.epa.gov/enviroatlas)).

**Connection to Human Health: Social and Community Ties.** In urban areas, including public housing developments, access to common green spaces and the greenness of those areas are positively linked to neighborly activities, social and community ties, and more cooperative behavior across age groups (this and more information available from [www.epa.gov/enviroatlas](http://www.epa.gov/enviroatlas)).

**Connection to Human Health: PTSD (Post-Traumatic Stress Disorder).** A study conducted to evaluate the effectiveness of a 3-day fly-fishing trip in reducing measures related to PTSD found better significant acute effects for increases in self-assuredness, joviality, and serenity, as well as significant effects on better sleep and fewer feelings of guilt and sadness (this and more information available from [www.epa.gov/enviroatlas](http://www.epa.gov/enviroatlas)).

**Connection to Human Health: Air Quality.** Forests are important to the process of natural air filtration. Given that air pollutants negatively affect health by making some respiratory symptoms worse, the removal of these pollutants from the air by trees can decrease cases of such respiratory illness (this and more information available from [www.epa.gov/enviroatlas](http://www.epa.gov/enviroatlas)).

**Connection to Human Health: Happiness.** In a study using a phone app to record happiness levels in different environments, participants reported being significantly happier outdoors in all green or natural habitat types than in urban settings. Marine and coastal shorelines were the happiest locations (this and more information available from [www.epa.gov/enviroatlas](http://www.epa.gov/enviroatlas)).

**Connection to Human Health: Water Quality.** Studies show that wetlands can remove up to 99% of nutrients (Xiong et al., 2011), 89% of metals (Khan et al., 2009), and 100% of pesticides (Budd et al., 2009). This and more information available from [www.epa.gov/enviroatlas](http://www.epa.gov/enviroatlas).