Planning with Nature
Adaptation to Sea-Level Rise Workshop

The Watershed Game for Local Leaders - Coast Model

The Watershed Game is an interactive educational tool that allows players to explore connections between land management, vulnerabilities to flooding, and downstream water quality. Use the Watershed Game as an ice breaker to set the stage for a successful workshop.The game provides a lively and fun environment for workshop participants to get to know each other and become more familiar with key concepts.

Facilitation instructions[1]

***Planning with Nature* team roles:**

- Facilitator (1 person)
- Data Recorder (1 person), to track resiliency units, pollutant reductions, & money on Facilitator Scorecard
- Banker (1 person), to distribute and collect money
- Team supporters (2-4 ppl)

Preparation

- spread out (and tape if necessary) game board on a table.
- group tool cards by five land uses
- group money into five groups of (14) $5,000 bills (= $70,000 per batch)
- distribute 1 dry erase marker per team
- Have Team Scorecards at the ready (included at bottom of document)
- Have blank Plan Cards at the ready
- give clipboard & Facilitator Scorecard to the Recorder (included at bottom of document)
- give prepared Unanticipated Event card to the Facilitator
- Distribute hard candies to teams as they make good Resiliency gains

Clean-up helpers (everyone)

- collect, re-organize, and store all materials
- tip: place game board rolled inside out in the storage tube so it will lay flatter when placed on table

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Facilitator

- Welcome! Today we are going to use the Watershed Game as a fun activity that simulates certain aspects of the real world to explore the connections between how we manage land, vulnerabilities to flooding, and downstream water quality.

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[1] originally compiled by the GTM NERR CTP based on Watershed Game's Coast Model Instructions; modified by Dan Brumbaugh for *Planning with Nature* applications

- The **goal of the game** is to increase coastal resilience to flooding AND reduce nonpoint source pollution to the watershed to meet a Clean Water Goal that's been set for an imaginary estuary. To do this, players will be able to select and implement various tools or BMPs.
- Our **learning objectives** are to:
    - *Appreciate the diversity of adaptation measures that exist across sectors within a watershed.*
    - *Apply plans, practices, and policies to (1) improve resilience to climate change and (2) prevent or reduce nutrient pollution. Working to obtain 'co-benefits' when addressing a vulnerability to a threat is common within environmental management.*
    - *Choose solutions based on available funds, benefits, and feasibility.*
    - *Appreciate the value of collaborative, integrated planning across sectors for accomplishing more.*

- Please take a good look at the **Game Board**, which **represents a watershed.**
    - *Coastal watersheds like this one tend to be densely populated. In fact, 40% of the U.S. population lives in coastal counties which only account for 10% of the country's land area.*
    - *As you just heard, in the Planning with Nature framework, we refer to watersheds at this ~scale as **Operational Landscape Units (OLUs)***

- Coasts can support high population densities because of diverse natural resources in a small area such as large rivers, bays, estuaries, and beaches [barrier islands].
    - **Illustrate on Game Board:**
        i. *The **river** drains a large upstream watershed and naturally provides nutrients and rich sediments to the coast.*
        ii. ***Coastal estuaries** provide critical food and places for fish and wildlife to breed as well as migration stopovers for many birds.*
        iii. ***Barrier islands** (or in our cases, **outer coast beaches**) help protect coastal wetlands (including many smaller bar-built estuaries).*

- On the game board, various **landscape features** support the ways that people are using the land:
    - *Rich river delta soils support **Agriculture** (and silviculture).*
    - *Abundant freshwater, natural resources, shipping access, and recreation opportunities support an **Urban Center and Residential Area.***
    - *A protected harbor and access to shipping routes upstream and offshore support **Ports and Industry.***
    - *Forests, estuaries, barrier islands, abundant birds, wildlife, and fisheries support robust tourism and recreation in the **Rural Coast**.*
    - *An original subsistence community (SW portion of the Game Board) is now surrounded by ports and industry and is vulnerable to flooding.*

- U*pstream nutrients flowing into coast waters support high fish and shellfish populations.*

- In our watershed, there are several areas **vulnerable to flooding** and **water quality impacts**.
    - *As we know, floods and runoff are **natural occurrences** in coastal areas, but are **exacerbated** by human activities, and have become more severe and damaging.*
    - *Changes in **precipitation patterns**, **water management**, and **impervious surfaces** have affected the timing, quantity, and intensity of **stormwater runoff** and severity of **flooding events**.*
    - *Flooding and stormwater runoff mobilize **nutrients and sediments**, exacerbating nonpoint source pollution.*
    - *Impacts from intensive land uses both upstream and along the coast have **degraded water quality**.*
    - *Nutrients and sediment are natural, essential parts of a healthy ecosystem and are only **pollutants when in excess**.*
    - *Often these hazards and their impacts are addressed through **Vulnerability Assessments**, and we'll be talking about those shortly when we get to the framework.*

- Today we will focus on **community resilience** within our watershed, specifically to flooding.
    - **Note that flooding, when not too severe, can provide benefits including**
        i. *Recharging groundwater*
        ii. *Recharging wetlands*
        iii. *Constructing floodplains*
        iv. *Rejuvenating soil fertility*
        v. *Creating wildlife habitat*
        vi. *Increasing fish production*
    - **but severe floods can impact water quality by**
        vii. *Accelerating erosion*
        viii. *Increasing nutrient runoff*
        ix. *Disrupting drainage systems*
        x. *Causing spills of raw sewage or animal waste*
        xi. *Causing discharges of toxic substances from industrial, agricultural, and urban areas*

- This game also focuses on managing pollution, so we'll be focusing on **nitrogen** as well as flooding within the game, although the rest of the workshop today will be focused pretty exclusively on flooding.
    - **Eutrophication** is the process when additional, excess nutrients to lakes, rivers, or estuaries leads to excess plant growth.

- **Common symptoms of eutrophication include**:
    i. *Too much plant and algae growth (some types of algae that do well in eutrophic conditions can be toxic to humans and animals)*
    ii. *Loss of water clarity caused by algae*
    iii. *Low dissolved oxygen caused by plant respiration and especially decomposing plant and animal matter*
    iv. *Loss of habitats and aquatic life*
    v. *Water that is not swimmable, drinkable, or fishable*

- **Sources of excess nitrogen to waters include**:
    vi. *municipal sewage effluents*
    vii. *industrial wastewater effluents*
    viii. *use of animal manure and inorganic N fertilizers, and subsequent runoff/leaching/drainage*
    ix. *runoff from standing or burned forests and grasslands*
    x. *urban and suburban runoff*
    xi. *septic system leachate, and discharges from failed septic systems*
    xii. *other activities that can mobilize N (from long-term storage pools) such as land clearing and conversion, and wetland drainage*

- **Introduce Land-Use Team play, and assign participants to Land-Use Teams**.
    - *Everyone will work in teams assigned by land use.* Divide participants into teams around the game board.
    - *Each land-use team will pay for and use tools,* ***best management practices, or 'measures' as the Planning with Nature framework refers to them,*** *to increase resilience to flooding, and, at the same time, reduce pollution from their land use. Some of these tools are* ***natural or nature-based adaptation approaches*** *that we'll be considering later today.*
    - **Assistant** passes out **Team Scorecards**. **Have everyone take a look at what needs to be tracked and reported on each round.**
    - Ask teams to choose a Team Recorder to complete the Team Scorecard and a Team Banker to manage the team's money (teams work best with 3-5 participants).

- **Instruct teams to study their land use**. (1-2 minutes)
    - Ask teams to:
        i. Identify a specific location that seems especially vulnerable to flooding, shows flooding impacts, or that seems naturally more resilient to flooding.
        ii. Identify a specific location that shows evidence of possible water quality impacts.

- **Ask teams to report their findings**.
    - Ask each Land-Use Team to point out and describe a site damaged by, susceptible to, or resilient to flooding, and a likely source of pollution from their land use.

- **Provide, explain, and record the starting Resilience score**. Community resilience is the sustained ability of a community to use available resources to respond to, withstand, and recover from adverse situations. Communities that are resilient are able to minimize any disaster, making the return to normal life as effortless as possible.
    - *We will be working to increase resilience in this coastal community, as measured by **Resilience Units** or **RUs.** Our resilience measures are similar to ones within the National Flood Insurance Program's Community Rating System (CRS). [Within the CRS, progressive improvements to community flood resilience lead to progressive insurance premium discounts for residents within Special Flood Hazard Areas.]*
    - *The Agriculture, Industrial Port, Urban Center, and Residential land uses will all start with 0 RUs. The Rural Coast land use will start with 250 RUs because rural coasts have more natural areas intact that provide resilience to flooding.*
        i. *Have teams write their RUs on the Team Scorecard.*

- **Provide, explain, and record the starting pollutant load**.
    - *The game uses generic **Pollution Units** or **PUs** rather than actual measures of pollutant loads or concentrations to simplify playing. Game play begins with equal loads of pollution coming from each land use, though that is rarely the case in the real world. Each land use contributes 50 PUs of nitrogen at the beginning of the game (five land uses x 50 PUs = 250 PUs).*
        i. Have teams write 50 on the game board in each of their land-use score boxes and on their Scorecards.
    - *The upstream pollutant load is 200 PUs, resulting in a total load to the coastal waters of 450 PUs. [**Dan will write the Upstream Pollutant Load of 200 in its box on the Game Board, and 450 PUs in the main Game Board score box.**]*

- While playing the Watershed Game we are going to **work toward meeting a Clean Water Goal for nitrogen in this watershed.**
    - *The Clean Water Goal has been set at a level that has been determined through scientific study to protect human health and aquatic life in this estuary. Pollutant loads must be at or below this level to protect the water body and its many uses. Remember that nitrogen is natural and play important roles in the functioning of the estuary. Our goal is not to eliminate all nitrogen but to remove the excess amounts that lead to deteriorating water quality and health. Our Clean Water Goal today is 250. [**Dan will write 250 as the Goal in the Board Game score box.**]*
    - Relate this to a TMDL (Total Maximum Daily Load) under the Clean Water Act.

- Each land use will have a set of **Tool Cards** to use during game play. These are analogous to the **adaptation measures** we'll be talking about later.

- *Here is what a typical tool (or measure) card looks like. On the front, each card will have the name of the **measure**, the cost, resilience unit increases, and pollution unit reductions achievable with the card. The back of the card includes a description of the **measure**/tool/BMP, including how it works to increase resilience and reduce nonpoint source pollution. Each tool card will fit into a specific place on the game board within your specific land uses. The tool card will visually "fix" problems in the watershed.*

- Hopefully this **orients you to our coastal region, what the challenges are, and our goal of increasing resilience units and reducing our nitrogen pollution units.** There are three rounds of play, representing three years. During each round, each team will:
  - *Choose one Tool/Measure Card to play.*
  - *Describe the selected Card to the whole group when asked.*
  - *Place the Card in its correct location.*
  - *Fill in their Team Scorecard.*
    i. *Teams will track their own data.*
    ii. *Teams will calculate and report balances to the **Recorder** (or Facilitator)*
  - *Pay $$ to the **Banker**.*

- **Banker distributes money.** $70,000/team equals $5,000 bills x 14 (*do not distribute Tool Cards yet*)
  - *As a land-use team that is dedicated to prudent fiscal management, you must retain $5,000 by the end of year three (which we will go over more shortly).*

- As we all know, living in a coastal community means that we all need to have flood insurance. For year 1, **each team will need to record the cost of their flood insurance premium ($10,000) on their Team Scorecard.**

- **Banker distributes Tool Cards and instructs teams to study and choose their first Tool Card to implement**. (2 minutes)
  - Study both sides of the Tool Cards, discuss amongst your team, and choose a card to implement first. *Remind teams to wait until instructed to describe and play their Tool Card.*

- **Before teams play their first Tool Card, hold up a blank Plan Card and offer them an opportunity to buy a "plan."** (2 minutes)

  Before we begin Round 1, I have a flash offer for you. This is a one-time offer to invest in a plan for your land use. It is up to your team to decide whether or not you want a plan, but be aware that developing a plan takes time and monetary resources. The cost to your land-use plan will be $5,000. This may help you in the future as you work toward greater Community Resilience or the Clean Water Goal. Or you may see it as a deterrent, a waste of time, an investment in paperwork, or a report that just sits on a shelf. These are real choices and risks that can occur in planning. At any rate, I'll offer any land-use team this one-time offer to invest in a plan. Teams that pay for a plan should quickly agree on a name for their plan and use a marker to write the name on a Plan Card. Examples of plan names for different land-use groups are "Flood Safety for All" or "Containing Agricultural Waste

During Flooding." Does any team wish to invest in a plan?

- Have teams take turns **playing their Year 1 Measure Cards**. Each team should:
    - Describe the Tool/Measure Card (title, how it works, RUs increased, PUs reduced, cost).
    - Record data on their Scorecard.
    - Pay the **Banker**.

- In planning for Year 2, it's that time again to **pay for your flood insurance.** Teams that have reached 750 RUs will pay a reduced flood insurance rate of $5,000. Teams that have not reached 750 RUs will pay $10,000. Teams should pay the **Banker** (or Facilitator) and record the expense on their Scorecard.

- Teams should **calculate their end-of-year balances on their Scorecards**. Teams need to calculate and record their remaining funds, total RUs, and remaining PUs. The **Recorder** will calculate and record new watershed totals for RUs and PUs on the **Facilitator Scorecard**, as well as the additional PU reduction needed to reach the Clean Water Goal. [The facilitator will lead a short discussion about the progress made during Year 1.]

YEAR 2

- At the beginning of Year 2… **insert dramatic sound here** DUN DUN DUNNNNNN and hold up the Unanticipated Event card:

  Adapted from the Flood Unanticipated Event Card:

  Never underestimate Mother Nature's power! Due to a relentless series of atmospheric rivers, there have been very damaging floods throughout the coastal area*. Fields are flooded, buildings and infrastructure are damaged, and significant shoreline erosion and runoff have flushed sediment and nutrients downstream. Every land use has experienced damage, but planning pays off. Land Use teams that implemented a plan and/or increased resilience significantly in Year 1 had less damage and will be able to recover more quickly and at less cost.*
    - *If teams have no plan and less than 750 resilience units, they pay $10,000.*
    - *If teams have no plan and more than 750 resilience units, they pay $5,000.*
    - *If teams have a plan and less than 750 resilience units, they pay $5,000.*
    - *If teams have a plan and more than 750 resilience units, they pay $0.*

26. Teams should now **choose their second Measure Card to implement**. (1-2 minutes)

27. Have teams take turns **playing their Year 2 Measure Cards.** Each team should:
    - Describe the Tool/Measure Card (title, how it works, RUs increased, PUs reduced, cost).
    - Record data on their Scorecard.
    - Pay the **Banker** (or Facilitator).

28. And now it's time for **year 3 flood insurance premiums**. Teams that have reached 750 RUs will pay a reduced flood insurance rate of $5,000. Teams that have not reached 750 RUs will pay $10,000. Teams should pay the **Banker** (or Facilitator) and record the expense on their Team Scorecard.

29. **Teams should calculate their end-of-year balances on their Scorecards**. Teams need to calculate and record their remaining funds, total RUs, and remaining PUs. The **Recorder** will calculate and record new watershed totals for RUs and PUs on the **Facilitator Scorecard**, as well as the additional PU reduction needed to reach the Clean Water Goal. The facilitator will lead a short discussion about the progress made during Year 2. During the discussion, the **Recorder** will calculate the total money in the game before beginning Year 3. In the next step, the **Facilitator** will choose Unanticipated Events to ensure that a total of $50,000 to $70,000 remains across all the Land Use Teams as they prepare to play their last Tool Cards.
    - **What tool cards played so far do you think could be used in our real watersheds**?
    - **Who would need to be involved in implementing that tool card in real life**?

YEAR 3

30. The facilitator will **implement Year 3 Unanticipated Event card**(s). Select the specific Unanticipated Event AND which land uses are affected so that:
    - No Land Use Team has more than $20K remaining.
    - The total remaining money in the game should be in the range of $50,000 to $70,000 (prior to continuing with the selection and placement of the final Tool Cards).

    Potential Unanticipated Events:

    - *Spill* – Source must pay $10K for cleanup; nearby land uses must spend $5K to mitigate the impacts
    - *HAB* – could impact any land use
        i. If plan was purchased, cost is $5K
        ii. If no plan was purchased, cost is $10K
    - *Operation & Maintenance Needed* – targeted for Urban Center/Residential land uses
    - *Neglect (-$5K), Grant (+$5K), Maintenance Completed (+$5K)* – could impact any land use

31. **Discuss the feasibility of meeting the Clean Water Goal by the end of Year 3.** Discuss the number of pollution units that must be reduced to meet the goal and the amount of each team's remaining money. Point out that some teams may be very low on money and that no one team can meet the Clean Water Goal on its own, without running out of money. Remind the teams that they all must retain at least $5,000.

32. *Before we begin Round 3, let's look at our remaining pollutant load, our progress toward the Clean Water Goal, and remaining funds across teams. It does not look as though any one team can get us to the Goal. In fact, some teams may be broke; they don't have any more money to invest in practices towards clean water. Others have some money but not enough to meet the Goal on their own, using*

just their own Tools/Measures/BMPs. In reality, work in watersheds toward meeting Clean Water Goals cannot be approached one land use at a time. It is accomplished by multiple public and private partners working in cooperation with landowners across most or all land uses in a watershed simultaneously. ***To be most effective, work should be targeted toward locations in the watershed, no matter what land use it is, where we can achieve the most significant impact with the least cost. This requires intentional planning, collaboration, pooled resources, and partnerships.*** *In the last round I am going to invite you to pool all the remaining funds across all teams and examine and choose from the unused Measures. In other words, I am asking you to work together, across land use teams to see if we can pool resources and choose practices that will get us to our goal, perhaps surpass it.*

Teams should report any grants or loans on their Scorecard. Encourage teams to try to address the **needs of the subsistence community**.

33. Have the group **choose Measure Cards for Year 3.** Encourage debate and dialogue about ways to pool remaining funds to choose Tool/Measure Card(s) from any land use to achieve the Clean Water Goal. **Encourage teams to consider side benefits that tools may offer beyond improved water quality, especially increased resilience.** (5 minutes)

34. Have the Teams **play their final Measure Cards**. Each team should:
    - Describe the Tool/Measure Card (title, how it works, RUs increased, PUs reduced, cost).
    - Record data on their Scorecard.
    - Pay the **Banker** (or Facilitator)

35. The **Recorder** will calculate and write the final total Resilience Units (RUs), pollutant load (PUs), and remaining money on the **Facilitator Scorecard** for the game.

36. Talk about the group's progress in reducing flood risk. Discuss the importance of reaching higher resilience to flooding on a watershed basis, the impacts to annual flood insurance premiums, and the connection to the National Flood Insurance Program and Community Rating System.

37. Lead a discussion about their choices and whether the Clean Water Goal was met or not. If the Clean Water goal was not met, discuss why not. If met, congratulate the group for achieving the Clean Water Goal.

38. Facilitate a discussion about what the participants learned through their experience in playing the Watershed Game Coast Model. Ask leading questions about what they learned related to:
    - Best management practices to increase resilience to flooding and improve water quality
    - Collaborating across land uses on a whole watershed basis
    - The importance of reaching out to all populations in the watershed
    - The role natural areas play in flood resilience and water quality
    - **What tool cards played do you think could be used in your watersheds**?

- **Who would need to be involved in implementing that tool card in real life**?
- Discuss how each group's collection of tool cards/**measures** could be seen as a cartoon of an **adaptation strategy**. Ask how a real strategy would probably differ. Note that we'll be addressing such strategies as part of step 4 in the framework.

- Our **learning objectives** were to:
  - *appreciate the diversity of adaptation measures that exist across sectors within a watershed. (STEP 2)*
  - *apply plans, practices, and policies to (1) improve resilience to climate change and (2) prevent or reduce nutrient pollution. Working to obtain 'co-benefits' when addressing a vulnerability to a threat is common within environmental management.*
  - *choose solutions based on available funds, benefits, and feasibility.*
  - *appreciate the value of collaborative, integrated planning across sectors for accomplishing more.*

The Watershed Game — Coast Model — for Local Leaders

FACILITATOR SCORECARD

POLLUTANT (N, S, or P) = _____	POLLUTION UNITS (PUs)						
		YEAR 1		YEAR 2		YEAR 3	
CLEAN WATER GOAL (CWG) =	INITIAL BALANCE	PUs REDUCED	YEAR END BALANCE	PUs REDUCED	YEAR END BALANCE	PUs REDUCED	YEAR END BALANCE
INDUSTRIAL PORT	50	–	=	–	=	–	=
AGRICULTURE	50	–	=	–	=	–	=
URBAN CENTER	50	–	=	–	=	–	=
RESIDENTIAL	50	–	=	–	=	–	=
RURAL COAST	50	–	=	–	=	–	=
LAND USE SUBTOTAL	= 250		=		=		=
UPSTREAM LOAD	+ 200		+ 200		+ 200		+ 200
WATERSHED TOTAL PUs	= 450		=		=		=
ADDITIONAL REDUCTION NEEDED TO MEET CWG To calculate, subtract CWG from current watershed total	e.g., 450-275 = 175		=		=		CWG MET?

RESILIENCE UNITS (RUs)						PLAN + INSURANCE	
	YEAR 1	YEAR 2		YEAR 3		CHECK IF TRUE	
INITIAL BALANCE	RUs ADDED	RUs ADDED	POST YEAR 2 BALANCE	RUs ADDED	YEAR 3 FINAL BALANCE	PLAN? COST= $5,000	RUs (≥ 750?)
0			=		=		
0			=		=		
0			=		=		
0			=		=		
250			=		=		
TOTAL INITIAL RUs 250		*RUs ≥ 750:* *Reduce flood insurance to $5,000.*			FINAL TOTAL RUs		

Flood UE:	
# Checks	*Penalty*
0	*$10,000*
1	*$5,000*
2	*$0*

NOTES

FINANCIAL CALCULATIONS FOR YEAR 3					
LAND USE TEAM	INITIAL BALANCE	POST YEAR 2 BALANCE	YEAR 3 UE (SUBTRACT)	GRANT GIVEN (SUBTRACT) OR RECEIVED (ADD)	USABLE FUNDS EACH TEAM IMUST RETAIN $5,000)
INDUSTRIAL PORT	$ 70,000	$	_	$	$
AGRICULTURE	$ 70,000	$	_	$	$
URBAN CENTER	$ 70,000	$	_	$	$
RESIDENTIAL	$ 70,000	$	_	$	$
RURAL COAST	$ 70,000	$	_	$	$
	TOTAL INITIAL BALANCE $ 350,000	TOTAL BALANCE POST YEAR 2 $			FINAL BALANCE (≥ $25,000) $

November 2021 -- Please check the website for newer versions of this scorecard.

Sea Grant Minnesota

The Watershed Game

Coast Model for Local Leaders

LAND USE TEAM SCORECARD

Team Scorecard

Pollutant:

- ☐ NITROGEN
- ☐ PHOSPHORUS
- ☐ SEDIMENT

Land Use Team:

- ☐ INDUSTRIAL PORT
- ☐ AGRICULTURE
- ☐ URBAN CENTER
- ☐ RESIDENTIAL
- ☐ RURAL COAST

	EXPENSES ($)	TYPE OF EXPENSE	POLLUTION UNITS (PUs)	RESILIENCE UNITS (RUs)
STARTING TOTALS	$70,000		50	———
PRE-YEAR 1 ACTION	– $	Year 1 Flood Insurance		
YEAR 1 ACTIONS	– $	Plan		
	– $	Tool Card	– PUs	+ RUs
	– $	Year 2 Flood Insurance		
POST-YEAR 1 TOTALS	$		PUs Remaining	Total RUs
YEAR 2 ACTIONS	– $	Unanticipated Event		
	– $	Tool Card	– PUs	+ RUs
	– $	Year 3 Flood Insurance		
POST-ROUND TOTALS	$		PUs Remaining	Total RUs
YEAR 3 ACTIONS	– $	Unanticipated Event		
	+ / – $	Grant (Received or Given)		
	– $	Tool Card	– PUs	+ RUs
FINAL TOTALS	$		PUs Remaining	Total RUs

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