RIPE100: Federal Policy Proposal
Helping American Farmers Prosper
As They Invest in Our Climate and Environment

Rice Producers Report

RIPE STEERING COMMITTEE:

Members Serving in Their Personal Capacity:

Brandon Hunnicutt, Nebraska Corn Board and National Corn Growers Association
Brad Doyle, Arkansas Soybean Association and American Soybean Association
Meredith Ellis, Integrity Beef Alliance and U.S. Roundtable for Sustainable Beef
Jimmy Emmons, Oklahoma Cattlemen’s Association and No-Till on the Plains
Bryan Jorgensen, Jorgensen Land & Cattle
Fred Yoder, Solutions from the Land
Executive Summary

Rice farmers have a pivotal role to play in tackling climate change, but they shouldn’t sacrifice their own prosperity in the process. Policies that support clean energy for their environmental benefits are designed to offer clean energy businesses a reasonable return, not a cost-share. Farmers should have the same opportunity. However, in existing and proposed climate programs, farmers are only offered cost-share options in the form of carbon farming or conservation reimbursements. At Rural Investment to Protect our Environment (RIPE), our farmer-leaders are working to create a unique climate policy that is voluntary for farmers, and that works for them and the environment. Our RIPE100 plan is a proposal to directly pay agricultural producers $100 per acre for voluntary land stewardship practices that benefit the public and farmers’ bottom line. RIPE proposes compensating farmers fairly for the total public benefits they deliver by reducing greenhouse gas emissions, and improving soil health, cleaning and conserving water, mitigating floods, encouraging pollinators and biodiversity, recreation, and providing other environmental services. Farmers, public opinion, and peer-reviewed research support this approach, which offers producers a reasonable incentive to adopt effective conservation measures.

RIPE100 Payments Offer Rice Farmers Profitable Incentive

[Graph showing RIPE100 Payments Offer Rice Farmers Profitable Incentive]
Key Takeaways

- **Climate policy with carbon farming payments creates a net loss for rice producers of around $20 per acre.** Carbon farming payments offer rice producers about $17 per acre, while adopting relevant climate-smart agricultural practices costs rice farmers around $2-$27 per acre and rice input costs will rise from climate policies’ impacts on fertilizer and fuels by around $24 per acre.

- **RIPE100 offers $100 per acre, allowing rice farmers an average net profit of $62 per acre.** At $100 per acre, rice farmers can cover the full cost of practice adoption (i.e., $2-$27 per acre) and full costs of rising inputs created by climate policy on fertilizer and fuels (i.e., $17 per acre), delivering around $62 per acre in return.

- **Rice producers’ stewardship practices deliver $100-$585 per acre in environmental benefits.** The public benefits delivered by climate-smart rice practices deliver tremendous environmental benefits, far beyond their greenhouse gas value. With a 4:1 benefit-cost ratio, this type of program investment delivers significant public benefits.

- **RIPE100 proposes environment-improving practices vetted by rice farmers.** These include: no-till, alternate wetting and drying, dry seeding, post-harvest flooding with early drainage, and post-harvest flooding with dry seeding, plus others listed below.

- **Voluntary, farmer-friendly, simple enrollment, open to early adopters and allows all producers to participate.**

Call to Action

**Congress needs to hear from producer groups.** We’ve talked to members of Congress in both parties, and they’ve told us their doors are wide open to our approach. However, they need to hear from farmers that this is what farmers want. Our farmer-led approach to building the RIPE100 policy, has ensured that this proposal is favored by producers. In fact, a 2021 RIPE/Farm Journal poll found 78% of farmers support this policy direction. Please join the conversation about how RIPE100 can work for rice farmers and farmers of all kinds across America by subscribing to our newsletter at [www.RIPEroadmap.org/get-involved](http://www.RIPEroadmap.org/get-involved) and contacting us to learn about opportunities to serve on RIPE's Farmers Advisory Network and steering committee.

Contact:

**Martin Barbre, vice president of outreach and government relations,**
[mbarbre@RIPEroadmap.org](mailto:mbarbre@RIPEroadmap.org)

**Jamie Powers, director of agricultural outreach,** [jpowers@RIPEroadmap.org](mailto:jpowers@RIPEroadmap.org)
Introduction

About RIPE
RIPE is a farmer-led organization advancing a federal policy that would reward farmers with a reasonable return for voluntary stewardship practices as part of a climate policy package. Our board of directors and steering committee include farmer leaders serving in their personal capacity as well as: Arkansas Rice Federation, Iowa Corn Growers Association, Minnesota Farmers Union, National Black Farmers Association, North Dakota Farmers Union and North Dakota Grain Growers Association. We are proud of the diverse and bipartisan nature of our organization and invite additional agricultural groups at the national and state levels to join the RIPE conversation.

The RIPE100 proposal pivots away from the cost sharing of current private carbon farming options and USDA conservation plans by offering farmers a reasonable return that is greater than what the policy costs them and reflects the total public benefits that their conservation practices will bring, including greenhouse gas reduction, improved soil health and water quality, water conservation, flood mitigation and greater biodiversity. The plan is designed to create a coalition of agricultural and environmental stakeholders to benefit the climate, environment and farmers’ bottom lines.

RIPE proposes a pilot program and a nationally scaled program, which are outlined on our website and white paper.

The core policy principles of the RIPE100 plan are:

1. Allows producers to receive a reasonable return, with payment levels that surpass policy costs, including the full cost to implement voluntary stewardship practices plus indirect costs impacted by climate regulations such as higher fuel and fertilizer costs. This payment is $100 per acre for the pilot and first phase of the program.

2. Enables all farmers to participate with a farmer-friendly program that is simple and practical. The list of qualifying practices includes practical options, such as utilizing cover crops and nutrient management, on farms of all sizes and types. The simple enrollment program would not include ranked applications, so all farmers can participate.

3. Rewards early adopters and demonstrates greenhouse gas “additionality,” allowing all farmers to be compensated for the environmental benefits they deliver regardless of when they adopted conservation practices.

4. Compensates voluntary stewardship at levels that align with the combined environmental values delivered, including mitigating climate change, improving water
quality, enhancing soil health, conserving water, preserving biodiversity, protecting endangered species, mitigating floods and improving air quality.

5. **Promotes equity and inclusion** by addressing barriers that have often kept farmers of color, smaller diversified farmers, women farmers and beginning farmers from participating in agricultural programs.

6. **Does not compete for funds against existing safety net programs.** The program will be appropriated as part of new funding streams for climate change and environmental benefits, such as a new title in the Farm Bill or a climate bill. (A pilot or initial phase may be authorized and appropriated within standard funding vehicles.)

7. **Complements existing markets and programs by allowing stacking payments up to the public value delivered by the practice.** Program will leverage biofuel markets, and other conservation programs and policies, such that producers may receive benefits from multiple programs so long as the total payment may not exceed the value the public receives from the practices.

**Program Design**

The simple, transparent policy design allows farmers to focus on farming rather than complex federal paperwork. To participate, farmers will:

1. **Select a practice from the menu of options.** Qualifying practices include measures for each farm type that deliver environmental benefits that surpass policy costs. Practices are widely applicable and include utilizing cover crops, no-till, comprehensive manure management planning, and the set of rice practices listed above.

2. **Receive free technical assistance.** Farmers attend a free workshop and take advantage of free technical assistance. Prior to second-year payments, participants will develop a tailored farm stewardship plan supported by free technical assistance.

3. **Self-verify with a simple process.** To verify, farmers submit receipts and field notes. USDA has authority to audit 5% of participants to ensure proper use of public funds.

4. **Receive $100 per acre payment without caps on acreage.** RIPE100's goal is to allow all farmers to enroll as many acres or animal units as they wish. Crop producers are generally compensated per acre and animal feeding operations are compensated per animal unit. A pilot program may include caps determined by program funding.

5. **Receive stewardship and equity premiums, if eligible.** Practices that deliver particularly high levels of environmental benefits will be eligible for premium payments. For farmers who confront historic barriers, including small farmers and farmers of color, equity compensation will be provided.
Climate Policy Raises Input Costs

Through stewardship practices, farmers and ranchers can deliver tremendous value to shared natural resources by improving water, air and soil health, and biodiversity. However, they are unlikely to implement those practices or support comprehensive climate policy if it negatively impacts their bottom line. Rice farmers in particular can implement conservation practices via tillage, irrigation and seeding systems. They can reduce rice-related greenhouse gas (GHG) emissions using proven management techniques that offer millions of dollars in public environmental benefits.

A risk to farmers from comprehensive climate policy is the extra financial burden it will impose on them through higher costs on inputs and possible regulations. RIPE commissioned World Agricultural Economic and Environmental Services (WAEES) to conduct an economic assessment of the cost of climate policy on agriculture, utilizing USDA Agricultural Resource Management Survey data from nine regions. We estimate that climate policies' impact on the national economy in 2023 would be equivalent to $20 per ton of GHG and $54 per ton in 2030. The increased carbon price leads to higher fertilizer, fuels and capital costs, and other inputs. The WAEES assessment analyzes the higher costs by commodity based on the input costs from USDA cost of production studies. It indicates rice production costs will increase by around $24 per acre in 2023 and $64 per acre in 2030. These figures present a worst-case scenario in terms of potential costs to farmers, since the

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1 This estimate is used by comparing the Energy Innovation analysis of the House climate plan’s level of GHG reductions to the Resources for the Future E3 Simulator that estimates carbon price impact on GHG reductions. Different perspectives exist on if the cost of climate policy by command and control, as is the House Democratic plan, will be higher or lower than a carbon price model predicts. Credible evidence can support both arguments. We offer this comparison as a rough estimate to illustrate the order of magnitude of impact, using the publicly available tools offered by Energy Innovation and RFF, who are leading think tanks in the field of climate policy.

www.rff.org/publications/data-tools/carbon-pricing-calculator/

2 Methodological details are provided in the Appendix.
model does not integrate likely advances in research and development nor changes by input providers that would reduce the GHG intensity of products. RIPE’s payment model is designed to protect farmers from this worst-case scenario.

Current carbon farming options, which typically offer around $17 per acre for conservation practices, do not fully compensate for the costs of climate policy on top of the costs of implementing practices. This leaves farmers with a net loss of around $20 per acre.

The Solution

RIPE100 addresses this challenge by including a fair return to agricultural producers for their voluntary investments in stewardship practices that deliver public benefits. We propose paying farmers in alignment with the stacked ecosystem service value of stewardship practices. This means rice farmers would be compensated not just for their carbon, but also for the clean water, soil health, water conservation, pollination, biodiversity and other ecosystem services they provide. Our analysis indicates that these environmental benefits to the public average over $100 per acre, while compensating them for the climate benefits alone would be only about $15 per acre.
Stewardship Practices

RIPE defines qualifying practices as stewardship practices that deliver over $100 per acre in public benefits. Practices unique to rice growers and additional practices that meet this criteria are listed below.\(^3\)

**Rice Industry Practices**
- No-Till (NRCS protocol code 329)
- Alternate wetting and drying (NRCS 449)
- Dry seeding\(^4\) (CARB Compliance Offset Protocol)
- Post-Harvest flooding (NRCS 646) with early drainage (NRCS 449)
- Post-Harvest flooding (NRCS 646) with dry seeding (CARB)

**Additional Practices**
- Cover crops (NRCS code 340)
- Reduced-till (345)
- Comprehensive nutrient management plan and implementation (102)
- Nutrient management (590)
- Feed management (592)
- Prescribed grazing (528)
- Filter strips (393)
- Riparian herbaceous cover (390)
- Riparian forest buffer (391)
- Forage and biomass planting (512)
- Silvopasture (381)
- Maintaining grass cover on expiring Conservation Reserve Program contracts and historic native grasslands.

RIPE is actively working to expand the list of practices by compiling USDA and academic literature, and communicating with farmers to identify what practices are important to them.

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\(^3\) Data on public benefit value is compiled mainly from USDA studies as well as academic sources, and methodological details are provided in the appendix and RIPE100 white paper. Additional rice practices provide over $100 per acre in environmental benefit. However, they are not included in this list because they cost over $100 per acre to implement. These practices include Filter Strips, Riparian Herbaceous Covers and Riparian Forest Buffers. Rice producers who implement these practices will be eligible to receive a $100 per acre payment in Phase 1.

\(^4\) Following the compliance offset protocol established by the California Air Resources Board, dry-seeding activities may be eligible for payment only in the California rice growing region.
Rice Stewardship Practices Provide Robust Environmental Benefits in Addition to Carbon Value

Rice Stewardship Practices Provide Environmental Benefits that Surpass Carbon Farming Values
Net Economic Impact

RIPE100 offers farmers a payment of $100 per acre, fully covering costs associated with practice implementation and increased costs of inputs, such as fertilizer, from climate policy. And because it rewards farmers for the value of their ecosystem services beyond carbon farming, RIPE100’s ecosystem service payments provide a profit incentive. The cost of climate policy and practices will fluctuate over time, so to protect farmers, the legislative language will specify that payment levels must always surpass policy costs.

For methodology and ecosystem services values, see appendix and the RIPE100 white paper at RIPEroadmap.org/research-and-policy.
Appendix and References

The following chart includes practices that provide at least $100 per acre of environmental benefit and cost under $100 per acre or AU to implement.

**RIPE100 Practices Provide Robust Environmental Benefits**

![Graph showing environmental benefits of practices](image)

- **Carbon Value at $20/ton**
- **Healthy Soil**
- **Water Savings**
- **Recreational/Commercial Fishing**
- **Biodiversity**
- **Air Quality (Human Health)**
- **Water Quality**
Methodology for the development of costs in agriculture associated with potential climate policy scenarios is provided in the following report and associated models developed by World Agricultural Economic and Environmental Services.

Kruse, J., 2020, Measuring the Implication of a Fuel Carbon Pollution Fee for Agricultural Commodities, World Agricultural Economic and Environmental Services (WAEES), Report to RIPE

WAEES analyzed the cost of production using USDA Economic Research Service data on 10 commodities using regional data from the nine USDA Agricultural Resource Management Survey regions. It applied a carbon price to each input to calculate the cost of climate policy on each commodity.
While Congress is not prioritizing a carbon price policy at this time, RIPE estimates the cost of the climate policies in these terms to allow for an approximate calculation of impact of climate policies of any kind on the agricultural sector. RIPE relied on the Energy Innovation analysis of the House Select Committee on the Climate Crisis’s 2020 plan’s level of GHG reductions and converted the GHG reductions to estimated equivalent carbon prices using the Resources for the Future E3 Simulator. Differing credible perspectives exist as to whether the cost of climate policy by command and control, as is the House Democratic plan, will be higher or lower than a carbon price model predicts. We offer this comparison as a rough estimate to illustrate the order of magnitude of impact, using publicly available tools offered by WAEES and Resources for the Future. The House plan approximates the equivalent of a carbon price of $20 per ton around 2023 and $54 per ton in 2030, so these are the two carbon prices applied to WAEES analysis and used throughout this paper.

WAEES uses a cost-of-production model that aggregates the direct cost impacts of a carbon fee on energy costs with the indirect costs from inputs such as fertilizer, chemicals, machinery and customer services, estimated by the share of energy costs in the production of each of those inputs. The impacts on these embedded energy costs are calculated by using the U.S. Bureau of Census annual and five-year census of manufacturers data. This data measures gross receipts and detailed expenses for each industry as a whole segmented by North American Industry Classification System code classifications. Based on this data, they estimate the percent of total expenses that is accounted for by the various energy components including liquid fuels, natural gas and electricity. A carbon price that reflects each of those fuel types is applied, using the conversion factors from the Energy Information Administration and Environmental Protection Agency.

The findings presented in the report are intended to provide a sense of scale for the cost impact and are not intended as a definitive projection. A cost-of-production model assumes that farmers and agribusinesses will not adapt to the new prices and thereby presents the worst-case scenario of what climate policy could cost farmers. For this reason, we do not provide findings for years beyond 2030 because the industry will adjust in ways that we cannot predict. There are some costs that are not fully accounted for in the WAEES model, including seed cost changes. RIPE welcomes engagement and partnership with stakeholders to refine this methodology and develop updated research.

Access to the WAEES cost-of-production report and accompanying tool is available to RIPE partners. For partnership opportunities, please contact RIPE Agricultural Outreach Director Jamie Powers at JPowers@RIPERoadmap.org.
Chart 2: Net Economic Impact of Climate Policy on Rice Production with Payment Only for Carbon Farming

Net Economic Impact of Climate Policy on Rice Production with Payment Only for Carbon Farming

<table>
<thead>
<tr>
<th>Practice</th>
<th>Implementation Costs</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-Harvest Flood With Early Drainage</td>
<td>$37/acre</td>
<td>USDA - NRCS. 2018 CSP Payment Schedule</td>
</tr>
<tr>
<td>Post-Harvest Flood With Dry Seeding</td>
<td>$35/acre</td>
<td>USDA - NRCS. 2018 CSP Payment Schedule</td>
</tr>
<tr>
<td>Alternate Wetting and Drying</td>
<td>$4/acre</td>
<td>USDA - NRCS. 2018 CSP Payment Schedule</td>
</tr>
<tr>
<td>No-Till</td>
<td>$2/acre</td>
<td>USDA - NRCS. 2018 CSP Payment Schedule</td>
</tr>
</tbody>
</table>
Dry Seeding | $0/acre
---|---

For methodology for the value of carbon payments at $20/ton, see Chart 3. For methodology for the average cost of climate policy on farming inputs, see Chart 1.

Chart 3: Environmental Value of Rice Practices

<table>
<thead>
<tr>
<th>Ecosystem Service</th>
<th>$/Acre/Year</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate Wetting &amp; Drying</td>
<td>$100</td>
<td></td>
</tr>
<tr>
<td>Dry Seeding</td>
<td>$109</td>
<td></td>
</tr>
<tr>
<td>No-Till</td>
<td>$112</td>
<td></td>
</tr>
<tr>
<td>Post-Harvest Flood - Early Drainage</td>
<td>$507</td>
<td></td>
</tr>
<tr>
<td>Post-Harvest Flood - Dry Seeding</td>
<td>$583</td>
<td></td>
</tr>
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</table>
The USDA study “Greenhouse Gas Emissions, Irrigation Water Use and Arsenic Concentrations; A Common Thread in Rice Water Management” by Merle, A. et al. (2014) finds that AWD in Arkansas reduces GHG emissions by 4,319 kg CO2 eq/ha. This equals 1.787 metric tons CO2 eq/acre. Multiplied by $20/ton, this equals $36/acre. The study “Alternate Wetting And Drying Reduces Aquifer Withdrawal In Mississippi Rice Production Systems” by R. Lee Atwill, et al. (2020) finds that AWD reduces diesel costs by a baseline average of $83/ha at a per liter cost of $.70. This equates to a 118L/ha diesel reduction, or 47.75 L/ acres. Each liter of diesel emits .0026 metric tons of CO2. 47.75 L/acre * .0026 tons/L equals .13 tons of CO2/acre. Multiplied by $20/ton of CO2, this equals $3/acre.


<table>
<thead>
<tr>
<th>Ecosystem Service</th>
<th>$/Acre/Year</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate Change Mitigation</td>
<td>$10-$34</td>
<td>Low-end value: A 2020 paper by the Environmental Defense Fund finds that replacing wet seeding with dry seeding, as approved by the California Air Resources Board, would reduce greenhouse gas emissions by 260,800 tCO2eq/year in the Sacramento Valley. NRCS indicates that 500,000 acres of rice are grown in this region. Therefore, dry seeding provides a GHG mitigation value of .47 metric tons CO2eq/acre. Multiplying this value by $20/metric ton CO2eq equals $10/acre. Sources: Jeremy Provile, et al. “Agricultural Offset Potential in the United States,” EDF. April 2020. 1 “Creating and Quantifying Carbon Credits From Voluntary Practices on Rice Farms in the Sacramento Valley: Accounting for Multiple Benefits”</td>
</tr>
<tr>
<td><strong>Water Savings</strong></td>
<td><strong>$8</strong></td>
<td></td>
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<tr>
<td>-------------------</td>
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<td></td>
</tr>
<tr>
<td><strong>Air Quality</strong> (Human Health)</td>
<td><strong>$79</strong></td>
<td></td>
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</tbody>
</table>

**Water Savings**

Lunquist et al. (2015) found a mean water use reduction of 271.5 fewer cubic meters per acre, or .22 acre-feet/acre, for dry-seeded rice compared to wet-seeded rice in California. NRCS values water savings at $36/acre-foot in current dollar values. Multiplying the two values equals $8/acre.

Sources:

**Air Quality (Human Health)**

According to the Arkansas Rice Production Handbook, wet-seeded rice requires 25% more nitrogen fertilizer than dry seeded rice. The handbook provides guidance for N application for dry-seeded rice at an average rate of 135 pounds N/acre, or 61.23 kg N/acre. A 25% increase would thus equal 15kg N/acre. Keeler et al. (2016) found the human health cost of N fertilizer in each county of Minnesota due to NH3 emissions. The average cost in a single county was $4.75/kg of N fertilizer, or $5.24/kg N in 2021 dollars. Multiplying 15kg N/acre by $5.24/kg N equals $78.60/acre.

Sources:

**High-end value**

Methane:

- A 2015 study found that in California trials, dry-seeded rice reduced emissions by 149kg methane/ha compared to wet-seeded rice, or 1.5 metric tons of CO2e/acre. Multiplied by $20/ton, this equals $30/acre.


Nitrous Oxide:

- According to the Arkansas Rice Production Handbook, wet-seeded rice requires 25% more nitrogen fertilizer than dry-seeded rice. The handbook provides guidance for N application for dry-seeded rice at an average rate of 135 pounds N/acre or 61.23 kg N/acre. A 25% increase would thus equal 15kg N/acre. Keeler et al. (2016) find the social cost of N fertilizer to be at least $.5/kg in each county of Minnesota due to N2O emissions. They derived this number using a SCC of $38/metric of CO2e. Therefore, a SCC of $20/metric of CO2e would convert $.5/kg of N to $.26/kg of N. Multiplying 15kg N/acre by $.26/kg N = $4/acre.

Sources:
<table>
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<tr>
<th>Ecosystem Service</th>
<th>$/Acre/Year</th>
<th>Citation</th>
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</thead>
<tbody>
<tr>
<td>Carbon Sequestration</td>
<td>$7</td>
<td>The 2018 “Economic Assessment for Ecosystem Service Market Credits From Agriculture on Working Lands,” report to the Ecosystem Services Market Consortium by Agribusiness Consulting indicates that the GHG value of no-till is $7/acre. On page 15, it says that in 2017, 95,578,000 acres of field crops were already using no-till, and this reduces CO2e by 33,860,000 tonnes. This equals .35 t/acre, which when multiplied by $20/ton is $7/acre. Page 15 also cites 103 million acres of field crop area currently under conventional tillage could be converted to no-till, and this would reduce GHG emissions by another 37.5 million tonnes. This simplifies to .36t/acre, which also multiplies to $7/acre.</td>
</tr>
<tr>
<td>Soil Conservation</td>
<td>$16</td>
<td>In “Environmental and Economic Costs of Soil Erosion and Conservation Benefits,” Pimentel et. al (1995) stated that, “In the United States, an estimated 4,000,000,000 tons of soil are lost every year” on cropland. The study estimated the economic cost of specific types of erosion. In “The Value of the Reservoir Services Gained with Soil Conservation,” Hansen and Hellerstein (2007) estimate the costs of erosion, stating that “a one-ton reduction in soil erosion provides benefits ranging from zero to $1.38 (in 2007 dollars).” Values were converted to 2020 dollars and compared to a $20/ton carbon price.</td>
</tr>
<tr>
<td>Total</td>
<td>$112</td>
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Chart 3, Column 3: No-Till
### Chart 3. Column 4: Post-Harvest Flood With Early Drainage

<table>
<thead>
<tr>
<th>Ecosystem Service</th>
<th>$/Acre/Year</th>
<th>Methodology</th>
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<tbody>
<tr>
<td>Climate Change Mitigation</td>
<td>$15</td>
<td>A 2010 NRCS report indicates that winter flooding combined with midseason drainage reduces GHG emissions by .73 metric tons CO2e/acre compared to a baseline of only winter flooding or only residue incorporation. 0.73 metric tons CO2e/acre multiplied by $20/metric ton CO2e equals $15/acre. Source: “Creating and Quantifying Carbon Credits From Voluntary Practices on Rice Farms in the Sacramento Valley: Accounting for Multiple Benefits for Producers and the Environment,” NRCS, 2010. <a href="http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1044916.pdf">www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1044916.pdf</a></td>
</tr>
<tr>
<td>Water Quality - Reduced Polluted Water Export (Post-Harvest Flood)</td>
<td>$481</td>
<td>Nitrate-removal systems in Minnesota caused supply costs to rise from 5 to 10 cents per 1,000 gallons to over $4 per 1,000 gallons. A 2009 study by Scott Manley, et al. finds that flooded fields reduce water export by 1155 m3/ha, or 123,477 gallons/acre. The study also finds that flooded fields reduced nitrate export by .10 kg/ha (100% reduction rate). Therefore, the amount of polluted water entering local water sources would reduce by 123,477 gallons/acre. This water would not need to be treated for nitrate removal. Multiplied by $3.9/1,000 gallons, this reduction in polluted water equals $481/acre. Sources: - Nutrient Pollution. EPA. Accessed 2021. - Manley et al. “Soil and Nutrient Retention in Winter-Flooded Ricefields with Implications for Watershed Management.” Journal of Soil and Water Conservation. 2009. <a href="http://www.jswconline.org/content/64/3/173">www.jswconline.org/content/64/3/173</a></td>
</tr>
<tr>
<td>Reduced Soil Erosion (Post-Harvest)</td>
<td>$4</td>
<td>According to a Mississippi State University report, fall-disked fields allowed to drain freely after winter rains lost about 1,000 pounds of soil per acre. Fields with drain pipes closed to impound water during winter and with stubble left undisturbed after harvest lost only 31 pounds of soil per acre. With post-harvest flood, soil savings thus equal 969 pounds/acre, or .5 tons/acre. NRCS values reduction in soil loss at $8.29/ton in 2021 dollars, which</td>
</tr>
</tbody>
</table>

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**Note:** All calculations and methodologies are based on specific studies and reports referenced in the sources provided. The values are estimates and may vary based on local conditions and practices.
Flood) when multiplied by .5 tons/acre equals $4/acre.

Source:

Total $507

Chart 3, Column 5: Post-Harvest Flood With Dry Seeding

<table>
<thead>
<tr>
<th>Ecosystem Service</th>
<th>$/Acre/Year</th>
<th>Methodology</th>
</tr>
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<tbody>
<tr>
<td>Climate Change Mitigation</td>
<td>$4</td>
<td>A 2010 NRCS report indicates that winter flooding combined with dry seeding reduces GHG emissions by .20 metric tons CO2e/acre compared to a baseline of only winter flooding and/or residue incorporation. 0.20 metric tons CO2e/acre multiplied by $20/metric ton CO2e equals $4/acre. Source: “Creating and Quantifying Carbon Credits from Voluntary Practices on Rice Farms in the Sacramento Valley: Accounting for Multiple Benefits for Producers and the Environment,” NRCS. 2010.</td>
</tr>
</tbody>
</table>
| Water Quality - Reduced Herbicide (Post-Harvest Flood) | $7          | A Mississippi State University report shows that post-harvest flooding reduces herbicide costs by $13.19/acre in 1999, which equates to $20 in 2021 dollars. According to the Arkansas Rice Production Handbook, the average cost of herbicide for the region in 2001 was $63/acre in 2021 dollars. This equates to a 32% reduction in herbicide application. Around .77kg/acre of pesticides are applied each year in California rice production. 32% of .77 equals .24 kg/acre. A 2005 study shows that 1 kg herbicide costs society $27, mostly in water quality reduction. $27/kg of herbicide multiplied by .24 kg/acre = $7/acre. Sources:
| Water Quality - Reduced Polluted Water Export (Post-Harvest Flood) | $481        | Nitrate-removal systems in Minnesota cause supply costs to rise from 5 to 10 cents per 1,000 gallons to over $4 per 1,000 gallons. A 2009 study by Scott Manley, et al. finds that winter-flooded fields reduce water export by 1155 m3/ha, or 123,477 gallons/acre. The study also finds that flooded fields reduced nitrate export by .10 kg/ha (100% reduction rate). Therefore, the amount of polluted water entering local water sources would reduce by 123,477 gallons/acre. This water would not need to be treated for nitrate removal. Multiplied by $3.9/1,000 gallons, this reduction in polluted water equals $481/acre. Sources:
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<tr>
<th>Water Quality - Reduced Soil Erosion (Post-Harvest Flood)</th>
<th>$4</th>
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<tr>
<td>According to a Mississippi State University report, fall-disked fields allowed to drain freely after winter rains lost about 1,000 pounds of soil per acre. Fields with drain pipes closed to impound water during winter and with stubble left undisturbed after harvest lost only 31 pounds of soil per acre. With post-harvest flood, soil savings thus equal 969 pounds/acre, or .5 tons/acre. NRCS values reduction in soil loss at $8.29/ton in 2021 dollars, which when multiplied by .5 tons/acre equals $4/acre.</td>
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<td>Source:</td>
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<thead>
<tr>
<th>Water Savings (Dry Seeding)</th>
<th>$8</th>
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<tbody>
<tr>
<td>A 2015 study shows a mean water use reduction of 271.5 fewer cubed meters per acre, or .22 acre-feet/acre, for dry-seeded rice compared to wet-seeded rice in California. NRCS values water savings at $36/acre-foot in current dollar values. Multiplying the two values equals $8/acre.</td>
<td></td>
</tr>
<tr>
<td>Sources:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air Quality - Human Health (Dry Seeding)</th>
<th>$79</th>
</tr>
</thead>
<tbody>
<tr>
<td>According to the Arkansas Rice Production Handbook, wet-seeded rice requires 25% more nitrogen fertilizer than dry-seeded rice. The handbook provides guidance for N application for dry-seeded rice at an average rate of 135 pounds N/acre, or 61.23 kg N/acre. A 25% increase would thus equal 15kg N/acre. Keeler et al. (2016) found the human health cost of N fertilizer in each county of Minnesota due to NH3 emissions. The average cost in a single county was $4.75/kg of N fertilizer, or $5.24/kg N in 2021 dollars. Multiplying 15kg N/acre by $5.24/kg = $78.60/acre.</td>
<td></td>
</tr>
<tr>
<td>Sources:</td>
<td></td>
</tr>
</tbody>
</table>

| Total | $583 |
Chart 4: Rice Stewardship Practices Provide Environmental Benefits that Surpass Carbon Farming Values

For the methodology for the total environmental benefit values and carbon farming values, see Chart 3.
Chart 5: RIPE100 Payments Offer Farmers Profitable Incentive

RIPE100 Payments Offer Rice Farmers Profitable Incentive

<table>
<thead>
<tr>
<th>Practice</th>
<th>Implementation Costs</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-Harvest Flood With Early Drainage</td>
<td>$37/acre</td>
<td>USDA - NRCS. <a href="https://www.nrcs.usda.gov/wps/portal/nrcs/detail/...">2018 CSP Payment Schedule</a></td>
</tr>
<tr>
<td>Post-Harvest Flood With Dry Seeding</td>
<td>$35/acre</td>
<td>USDA - NRCS. <a href="https://www.nrcs.usda.gov/wps/portal/nrcs/detail/...">2018 CSP Payment Schedule</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cost/acre</th>
<th>Source/Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-Till</td>
<td>$2/acre</td>
<td>USDA - NRCS, 2018 CSP Payment Schedule</td>
</tr>
</tbody>
</table>