U.S. Department of Energy
Categorical Exclusion Determination Form

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Proposed Action Title: Texas A&M University - A Field-Deployable Magnetic Resonance Imaging Rhizotron for Modeling and Enhancing Root Growth and Biogeochemical Function

Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): College Station, TX; Charleston, MA; Boulder, CO; Albuquerque, NM; Morrisville, NC

Proposed Action Description:

THIRD AMENDED NEPA DETERMINATION: (See attached original, First and Second Amended Determinations, dated 3/22/17, 2/27/19, and 6/9/20 respectively). This Third Amended Determination follows the approval of new milestones to support the project team's small-scale, research and development activities to extend their ongoing efforts to develop a lowfield MRI (LF-MRI) system that can image intact soil-root systems and integrate this instrumentation into a sorghum breeding, modeling, and trait discovery program. Specifically, the project team will optimize the resolution and throughput performance of the existing in-ground system. If successful, the project team will enable rapid and nondestructive analysis of root systems and LF-MRI phenotyping and genetic approaches to developing bioenergy sorghum with desired root ideotype.

Project activities will be conducted at existing facilities at Texas A&M AgriLife Research (College Station, TX); Harvard MGH (Charleston, MA); NIST (Boulder, CO); ABQMR, Inc. (Albuquerque, NM); and Soil Health Institute (Morrisville, NC) designed for the applicable activities. Project tasks continue to fit within the class of actions identified under the DOE Categorical Exclusion identified below and do not involve any extraordinary circumstances that may affect the significance of the environmental effects of the project. This assessment was based on a review of the proposed scope of work and the potential environmental impact of the project. Project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and local regulatory requirements. No modifications will be made to the existing facilities to accommodate the proposed work.

Categorical Exclusion(s) Applied:

A9 - Information gathering, analysis, and dissemination

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, including the full text of each categorical exclusion, see Subpart D of 10 CFR Part 1021.

Regulatory Requirements in 10 CFR 1021.410(b): (See full text in regulation)

☑ The proposal fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D.

To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

☑ There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal.

☑ The proposal has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

Based on my review of the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: GEOFFREY GOODE Digitally signed by GEOFFREY GOODE Date: 2023.01.19 10:34:42 -05'00' Date Determined: 01/18/2023

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U.S. Department of Energy
Categorical Exclusion Determination Form

Submit by E-mail

Proposed Action Title: Rhizosphere Observations Optimizing Terrestrial Sequestration (ROOTS) Program (FOA No. DE-FOA-0001565)

Program or Field Office: Advanced Research Projects Agency - Energy (ARPA-E)

Location(s) (City/County/State): AZ, CA, CO, FL, GA, IA, IL, KY, MA, MI, MO, NE, NM, OK, PA, TX, WA, WI, Nottingham, UK,

Proposed Action Description:

The ROOTS Program seeks to fund the development of novel, non-destructive, field-deployable technologies to: (1) measure root functional properties; (2) measure soil functional properties; and (3) advance models that accelerate selection and development of plant varieties. The ROOTS Program is composed of 10 small-scale research and development projects that will be conducted by universities, for-profit entities, and federal laboratories. If successful, ROOTS technologies will accelerate selection and development of crops that will greatly increase carbon uptake in soil and remove CO2 from the atmosphere, decrease N2O emissions, and decrease the energy intensity of agricultural production.

All of the 10 ROOTS projects (listed in Attachment A) are covered by this Determination and fit within the class of actions identified under the DOE Categorical Exclusions identified below and do not involve any extraordinary circumstances that may affect the significance of the environmental effects of the projects. This assessment was based on a review of the proposed scope of work and the potential environmental impacts of each project. Project tasks for all 10 projects under the ROOTS Program will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and Local regulatory requirements. For one project, Prime Recipient Pennsylvania State University, must obtain and maintain all required authorizations for all work involving recombinant DNA molecules and GM plants prior to beginning work with these materials. Penn State must also secure an interstate movement permit from USDA APHIS prior to transferring the transgenic materials between facilities in Wisconsin and Pennsylvania.

Categorical Exclusion(s) Applied:

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

B3.8 - Outdoor terrestrial ecological and environmental research

For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, including the full text of each categorical exclusion, see Subpart D of 10 CFR Part 1021.

Regulatory Requirements in 10 CFR 1021.410(b): (See full text in regulation)

☑ The proposal fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D.

To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

☑ There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal.

☑ The proposal has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

Based on my review of the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer:

Date Determined: 03/22/2017

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U.S. Department of Energy
Categorical Exclusion Determination Form

Submit by E-mail

Proposed Action Title: Texas AgriLife Research -- A Field Deployable magnetic Resonance Imaging Rhizotron for Modeling and Enhancing Root Growth and Biogeochemical Function

Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): Boulder, CO; Charleston, MA; Albuquerque, NM; College Station, TX

Proposed Action Description:

AMENDED NEPA DETERMINATION: (See attached original Determination, dated March 22, 2017)
This Amended Determination follows the approval of additional funds to support the project team's small-scale, research and development activities to develop portable magnetic resonance imaging (MRI) system for field imaging of root architecture and soil water distribution. Specifically, the project team will (1) develop a forward encoding model and conduct image reconstruction; (2) decrease image acquisition time by 40%; and (3) improve data compression to enable the machine to acquire 50% less data for the same image quality. If successful, the team will be able to improve and deploy a machine learning method to automate the process of converting sensor data to images for an innovative above-ground system capable of overcoming the limitations of heavier, power-demanding, state-of-the-art devices currently used.

Project tasks continue to fit within the class of actions identified under the DOE Categorical Exclusion identified below and do not involve any extraordinary circumstances that may affect the significance of the environmental effects of the project. This assessment was based on a review of the proposed scope of work and the potential environmental impact of the project. Project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and local regulatory requirements.

Categorical Exclusion(s) Applied:

A9 - Information gathering, analysis, and dissemination

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, including the full text of each categorical exclusion, see Subpart D of 10 CFR Part 1021.

Regulatory Requirements in 10 CFR 1021.410(b): (See full text in regulation)

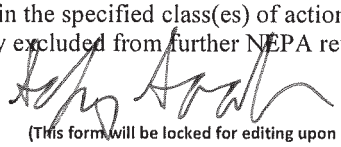
☑ The proposal fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D.

To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

☑ There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal.

☑ The proposal has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

Based on my review of the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: 

Date Determined: 02/27/2019

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Submit by E-mail

Proposed Action Title: Texas A&M University - A Field-Deployable Magnetic Resonance Imaging Rhizotron for Modeling and Enhancing Root Growth and Biogeochemical Function

Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): College Station, TX; Charleston, MA; Boulder, CO; Albuquerque, NM; Morrisville, NC

Proposed Action Description:

SECOND AMENDED NEPA DETERMINATION: (See attached original and First Amended Determinations, dated 3/22/17 & 2/27/19, respectively). This Second Amended Determination follows the approval of a new team member, additional funds, and milestones to support the project team's small-scale, research and development activities to extend their ongoing efforts to develop a lowfield MRI system that can image intact soil-root systems and integrate this instrumentation into a sorghum breeding, modeling, and trait discovery program. Specifically, the project team will (1) develop an above-ground MRI system and (2) optimize the resolution and throughput performance of the existing in-ground system. If successful, the project team will enable rapid and nondestructive analysis of root systems and LF-MRI phenotyping and genetic approaches to developing bioenergy sorghum with desired root ideotype.

Project activities will be conducted at existing facilities at Texas A&M AgriLife Research (College Station, TX); Harvard MGH (Charleston, MA); NIST (Boulder, CO); ABQMR, Inc. (Albuquerque, NM); and Soil Health Institute (Morrisville, NC) designed for the applicable activities. Project tasks continue to fit within the class of actions identified under the DOE Categorical Exclusion identified below and do not involve any extraordinary circumstances that may affect the significance of the environmental effects of the project. This assessment was based on a review of the proposed scope of work and the potential environmental impact of the project. Project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and local regulatory requirements.

Categorical Exclusion(s) Applied:

A9 - Information gathering, analysis, and dissemination

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, including the full text of each categorical exclusion, see Subpart D of 10 CFR Part 1021.

Regulatory Requirements in 10 CFR 1021.410(b): (See full text in regulation)

☑ The proposal fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D.

To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

☑ There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal.

☑ The proposal has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

Based on my review of the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: Date Determined:

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Attachment A: Projects in the ROOTS Program (FOA No. DE-FOA-0001565)

Prime Recipient	Project Title
Colorado State University	Root Genetics In The Field To Understand Drought Adaptation And Carbon Sequestration
Iowa State University	High-throughput, High-resolution Phenotyping of Nitrogen Use Efficiency Using Coupled In-plant and In-soil Sensors
Lawrence Berkeley National Laboratory (1565-1540)	An Integrated Imaging and Modeling Toolbox for Accelerated Development of Root-focused Crops at Field Scales
Lawrence Berkeley National Laboratory (1565-1553)	Associated Particle Imaging (API) for Non-Invasive Determination of Carbon Distribution in Soil
Pennsylvania State University	DEEPER: An Integrated Phenotyping Platform for Deeper Rooting
Sandia National Laboratories	Multi-Modal Monitoring of Plant Roots for Drought and Heat Tolerance in the US Southwest
Stanford University	Thermoacoustic Root Imaging, Biomass Analysis, and Characterization
Texas A&M AgriLife Research	A Field-Deployable Magnetic Resonance Imaging Rhizotron for Modeling and Enhancing Root Growth and Biogeochemical Function
UHV Technologies, Inc.	Low Cost X-Ray CT System for In-Situ Imaging of Roots
University of Florida	Rays for Roots - Integrating Backscatter X-ray Phenotyping, Modeling, and Genetics to Increase Carbon Sequestration and Switchgrass Resource Use Efficiency