Saskatchewan Environmental Society

Comments to the Canadian Nuclear Safety Commission regarding:

NexGen Energy Ltd.'s Rook 1 Environmental Impact Statement

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INTRODUCTION

The Saskatchewan Environmental Society appreciates the opportunity to review the draft environmental impact statement for NexGen Energy's proposed Rook 1 uranium mine and mill development. While recognizing the depth and thoroughness of the study, we have identified several issues that need to be addressed in a final version. Our questions and recommendations are included within each section of the comments which follow and are also listed in summary form at the end of this document.

1. CONCERNS ABOUT THE SCOPE OF THE ENVIRONMENTAL ASSESSMENT

Several of our concerns relate to *fragmentation* as one of the inherent shortcomings of project-based impact assessments. Disconnecting parts of larger developments or land and resource use activities does not provide a sound basis for a comprehensive evaluation of that development or activity's overall impacts. Requiring a cumulative effects component to be included certainly helps, but only if properly done.

A primary example of *fragmentation* is the role it plays in characterizing the reason for, and benefits from, the Project. In its description of the Project's purpose and benefits, and especially in its discussion of alternatives to the Project, NexGen makes the argument that the extracted uranium will support Canada's transition to a low-GHG economy (EIS page 470/4067). However, just as renewable alternatives do not actually provide energy unless wind or moving water spin the turbines, or the Sun shines on the photovoltaic panels, uranium concentrate does not actually provide energy without the fabrication of nuclear fuel, the construction, operation and decommissioning of reactors, and the long-term storage and management of highly radioactive wastes. *All* those additional steps that enable use of non-renewable nuclear energy involve GHG emissions, among many other significant environmental impacts. Therefore, the case for seeking approval for the Rook 1 Project should not be *disconnected* from everything else that is required if the predicted benefits are to be realized. It should instead be accurately embedded within the broader context and consequences of including non-renewable nuclear energy in our energy system.

R.1. *SES recommends that evaluation of the justification for, benefits of, and alternatives to the Project be based on a fully comprehensive description of how it might fit within the transition to a sustainable energy future.*

NexGen describes the Project as consisting of the construction, operation, and closure phases of its proposed Rook 1 mine and processing facility. However, these phases of the overall uranium exploitation activity have required nearly a decade of both regional and locally intensive exploration, hundreds of diamond drill holes, and installation of supporting infrastructure such as the 13 km main access road and a substantial exploration camp facility. Those *preceding* (and continuing) phases, all prerequisite components of the overall uranium exploitation activity, were all permitted without an environmental assessment, and their considerable impacts are not fully incorporated into this EIS. For example, although described as part of "current activities", the exploration camp facilities do not even appear on the Project's facilities and infrastructure map (EIS page 38/4067, Fig. 1.2-5).

R.2. *SES recommends that NexGen be required to incorporate into the final EIS the implications of its exploration and related pre-mining developments as essential components of the Project.*

The cumulative effects component in this EA has essentially been limited to including the nearby proposed Fission Uranium Corp. mine and processing facility, also on the shore of Patterson Lake, as the basis for characterizing a Reasonably Foreseeable Development" (RFD) scenario. This does not seem at all adequate given the scale and extent of NexGen's ongoing exploration and test-drilling program. The company describes its continuing efforts to develop more uranium mining projects in the region and states that, in addition to the Arrow deposit, "multiple new high-grade uranium discoveries have been made on NexGen's properties", including the Harpoon, Bow, and South Arrow deposits (www.nexgenenergy.ca/exploration/overview/). It is therefore *unreasonable* to exclude the proponent's own goals and future plans from the realistic consideration of likely cumulative effects impacts.

R.3. *SES recommends that NexGen be required to incorporate, into the cumulative effects component of the final EIS, the implications of its ongoing and planned additional efforts to expand and extend uranium exploitation activity beyond the Arrow Deposit.*

Q.1. *How much of the environmental impact 'capacity' in the region should the first or any one developer be allowed to occupy, given that other future projects will also be seeking a share of that finite regional 'capacity'?*

2. TAILINGS MANAGEMENT

2.A) EXPERIENCE WITH DEEP UNDERGROUND STORAGE

As far as we have been able to determine, previous Canadian approaches to disposal of uranium mine tailings are limited to simply depositing them on the surface (e.g., at Gunnar, SK and Elliot Lake, ON), depositing them in lakes (e.g., at Beaverlodge, SK) or in flooded low areas (e.g., at Cluff Lake, SK), and, in more modern mining operations, placing them in prepared surface pits. We are not aware of any examples, either in Canada or elsewhere, where other approaches have been applied.

It appears, therefore, that NexGen is proposing an innovative approach in uranium mine tailings management, an approach that combines an underground, purpose-built tailings management facility and placement of cement-bound tailings as backfill in mined-out stopes. While there is some experience of this approach being used for disposal of coal, gold and potash mine tailings, we have seen no reference to its application in the uranium industry. This is significant because, as concluded by Tariq and Yanful (2013)[1]: "The variability and complexity of mine waste materials and behavior of cement in the individual composite matrices preclude a universally accepted generalized methodology."

There appear to be some significant advantages to storing mine tailings underground as backfill rather than in surface pits (www.tailings.info/storage/backfill). These would include reducing the risk of subsidence, reducing surface disturbance, and allowing the possibility of removing pillars from the mine tunnels and extracting more ore from them. Contaminants stored deep underground are much

[1] Tariq, A. &, Yanful, E. K. (2013). *A review of binders used in cemented paste tailings for underground and surface disposal practices*. Journal of Environmental Management, Vol. 131, pages 138-149.

further removed from surface water contact than are those stored on or near the surface. So there seems to be much to be said in favour of exploring this approach.

The disadvantages identified in the *tailings.info* article include the high cost, the risk of liquefaction of the backfill if saturation levels are high (note that the plan is to flood the mine at closure), and the risk of plugging of the pipeline carrying the cemented tailings or bursting of the pipeline. Portland Cement appears to be the most expensive component of Cemented Paste Tailings (CPT) operations and hence becomes the primary setback in its use as a binder. Concomitantly, the cement industry is one of the leading industrial emitters of greenhouse gases, particularly CO2. Its high manufacturing cost along with its recognition as a major source of CO2 emission has made cement production a target of criticism.

We therefore request that the following questions and issues be addressed in a final version of the EIS:

Q.2. *Are there documented examples of deep underground storage of uranium mine tailings? If so, please provide details of their history, including the nature, duration, and results of monitoring.*

Q.3. *What is the expectation for the structural longevity of the concrete/tailings backfill material? (A quick search indicates that concrete generally remains stable for 50 to 100 years, depending on the chemical environment in which it is located.)*

Q.4. *Have studies been done to determine the effect on mobility of the tailings components when the concrete breaks down?*

2.B) PREPARATION OF THE UGTMF CELLS

It appears (EIS page 671/4067) that the UGTMF storage cells are vertically oriented and that the plan is to place cemented paste backfill (CPB) plugs at the bottom and top of each cell. Presumably this is intended to limit release of contaminants. Two questions emerge:

Q.5. *Why is it not considered advisable to also line the sides of the* UGTMF storage *cells with CPB?*

Q.6. *What potentially leachable contaminants are in the CPB itself, given that it contains the leach residue from the mill process?*

2.C) ADAPTIVE MANAGEMENT AND LONG-TERM GROUNDWATER CONTAMINATION

NexGen states (EIS pages 3993 and 1240/4067) that "Groundwater seepage from the UGTMF and backfilled production stopes may adversely affect groundwater, surface water and sediment quality after closure" and that "The focus of the Groundwater Management and Protection Plan would be the establishment of monitoring systems to evaluate the effectiveness of the groundwater protection controls."

Given the uncertainties about the long-term movement of contaminants from the UGTMF and from backfill, NexGen is proposing to employ an Adaptive Management approach to potential problems that may become apparent sometime after closure.

Q.7. *If it were to be discovered, say 50 or 100 years after closure, that contaminants were found to be moving into groundwater faster than had been anticipated, what adaptive management options would be available at that point?*

Q.8. *Have the feasibility, effectiveness, and costs of potential groundwater contamination adaptive management options been determined?*

3. GREENHOUSE GAS EMISSIONS

3.A) OFF-SITE EMISSIONS

Section 7.4 of the EIS considers the potential effects of Rook 1 on climate change by estimating the Project's total GHG emissions, specifically of carbon dioxide, methane, and nitrous oxide. Included in this estimation are emissions from the Project's electrical generation, heating, on-site mobile equipment, land use change, waste incineration, explosive emissions and stationary combustion, but not mobile combustion (off-site transportation), nor from production and delivery of necessary material supplies for the Project.

This points to a major flaw in the way Environmental Assessments are "Scoped."
According to the EIS, corporations typically report their GHG emissions by classing them into Scope 1, Scope 2 and Scope 3:

Scope 1 - emissions from everything on the site, including from the LNG electric power plant, and from the diesel fuel used on site;

Scope 2 - emissions from energy – for electricity or heating - generated off-site and purchased by NexGen. The EIS states there are none since the Project will provide its own power.

Scope 3 - emissions that are "indirect," occurring because of the Project, but by parties not owned or controlled by the Project. The CNSC permits Scope 3 emissions to be omitted from the Project's GHG calculation.

3.A.1) TRANSPORTATION

Unless GHG emissions due to off-site transportation are included, the Project's total GHG emissions estimate is woefully inaccurate.

We contend that the carbon emissions from burning fuel for transporting people and cargo are integral to the Project, not "indirect" consequences such as a new gas station in La Loche, without which the Project could operate very well. Shipping 14 million kilograms of yellowcake every year for 24 years to Ontario is what the Project is all about. The mine operation will depend on aircraft and trucks delivering people and supplies. Transport is essential to every phase of the Rook 1 Project, from exploration to the reclamation and final decommissioning.

Thus, these are "direct" emissions, and we would suggest that simply dismissing them as outside its scope undermines the integrity of the EA itself.

R.4. *SES recommends that all GHG emissions associated with transport of people and materials to and from the site be included in the Project emissions estimate.*

3.A.2) CEMENT BINDER PRODUCTION

It is unclear where the cement binder required for tailings management will be produced and what the greenhouse gas implications are.

R.5. *SES recommends that all greenhouse gas emissions associated with production of cement used in the project be included in calculation of project emissions.*

3.A.3) POWER GENERATION

To provide the energy required, the EIS proposes an on-site power plant fueled by Liquid Natural Gas (LNG) rather than by diesel generators, an improvement in terms of GHG emissions. But again, the analysis is incomplete because the nearest LNG source appears to be 1,000 km away, and, just for the 24-year mine operation phase, the Project will need 12-15 truckloads of LNG per day.

There also is no account taken of the "upstream" emissions of the LNG fuel, which include GHG emissions from its extraction, liquification, storage and transportation.

R.6. *SES recommends that emissions associated with the production of LNG used in the project as well as its transportation to the site be included in calculation of project GHG emissions.*

3.A.4) CUMULATIVE EFFECTS

According to the Environmental Assessment Act (CEAA 2012), the cumulative effects of Reasonably Foreseeable Developments are to be addressed in the EIS. This was done, albeit inadequately, for many aspects of the Project but was not done regarding the Project's GHG emissions because, it is claimed, "the Application Case provides all required information for the federal government to consider the Project relative to the cumulative effects of historical, existing and future projects." This claim requires substantiation.

Q.7. *Which body of the federal government will be reviewing the cumulative GHG emission effects of historical, existing, and future projects?*

Q.8. *How will that review be included the current EA process for the Rook 1 Project?*

3.B) CARBON OFFSETS

Some mining companies, recognizing that their operations inevitably emit carbon into the atmosphere, compensate for that by contributing to carbon offsets, projects that store carbon or prevent its emission. For example, Mayfair Gold, which recently started a mine in north-eastern Ontario, plans to be able to claim carbon-neutrality thanks to carbon credits from funding solar-powered heating systems. (mayfairgold.ca/)

Carbon credits could be considered a form of mitigation, but more research is required to ensure that the designated activities do in fact mitigate emissions and/or store carbon and are endorsed by the people affected.

Q.9. *Will the final EIS include a plan for use of carbon offset measures as a component of mitigating the Project's GHG emissions?*

3.C) ACHIEVING NATIONAL AND PROVINCIAL TARGETS

NexGen suggests that the GHG emissions from the Project would represent only a small percentage increase in Saskatchewan's and Canada's current emissions and are therefore negligible. They state that (EIS page 978/4067) *"Emission of greenhouse gases from the Project would have an adverse effect on climate change…However, total Project emissions would be less than 0.3% of the provincial annual total emissions and less than 0.02% of the federal total annual emissions…At less than 0.3% of provincial baseline emissions the Project would not contribute significantly to the totals."* This logic would suggest that none of the individual emission sources, which collectively make up a large proportion of Saskatchewan's total emission problem, should be considered significant. This attitude would doom to failure our attempts to effectively mitigate climate change.

It is also important to address the claim that a new uranium mine will result in future lower GHG emissions and will help Canada meet the commitment made at Paris in 2015, to reduce emissions 40% by 2030.

NexGen argues that carbon emissions from this Project will be balanced by future emission reductions that result from replacement of fossil-fuel-powered electrical generation plants by new nuclear plants using Rook 1 uranium to create "carbon-free" electricity. However, the GHG emissions attributable to this Project began with the exploration phase and will continue over its 43-year lifespan. New nuclear plants are more than a decade away, as is the potential for any nuclear fuel that may derived from the prospective Rook 1 Project to be used in them, too late to contribute to Canada meeting its commitment to cut emissions by 40% by 2030. By 2030, before any new nuclear power comes on grid, Canada's coal-burning plants will have already been closed or converted to natural gas, presumably with carbon capture. Very competitively priced, expanded renewable energy projects will also be in place.

So even a fleet of nuclear reactors coming onstream in 2035-45 would not help Canada or Saskatchewan meet their 2030 emission-reduction commitments. *Now* is when we need to drastically reduce emissions. Waiting until 2045 will be too late; and in the meantime, new mines and mills will be adding their emissions to the total, requiring more serious reductions in other areas of the economy, and more risk of accelerating climate instability.

R.7. *SES recommends that Canada now focus on achieving its 2030 GHG emission reduction target, recognising that new, more ambitious reductions will be required after that date.*

3.D) CLIMATE CHANGE PREDICTIONS AND RISK EVALUATION

The EIS includes a detailed effort to predict future climate change impact on the Rook 1 Project, based on incomplete data from three weather stations and NASA's MERRA 2 dataset. It also acknowledges the inherent uncertainty around the predictions and risk assessment more generally.

We find the section lacking in detail, particularly in describing various scenarios and their consequences. The methodology, balancing the likelihood of an event with its consequences to determine a 'risk level', seems outdated, given current climate change experience. For example, the

risk level of severe drought resulting in inadequate water supply is labeled Moderate, but the consequences are not specified. How dry would it have to be for Patterson Lake's level to be dangerously low? How much would the risk of a wildfire increase during a multi-year long drought, which is more likely now than in the past due to climate change?

R.8. *SES recommends that the final version of the EIS take into account the recent, unexpectedly severe, global impacts of climate change as well as estimating the consequences for the project of extended drought and increased wildfire frequency and intensity.*

4. WATER QUALITY: THRESHOLDS FOR RADIONUCLIDES

We note (EIS page 1622/4067) that thresholds for COPC radionuclides were developed using U.S. Department of Energy values as "neither CCME nor Provincial guidelines are available". Table 10.2-7 (EIS page 1624/4067) shows that guidelines set by Health Canada for Pb210 and Ra226 are higher than those set by the World Health Organization.

Q.10. *On what basis was the decision made to use the Health Canada guideline for Pb210 and Ra226 water quality thresholds rather than the more conservative WHO figure?*

5. PROJECT INFRASTRUCTURE DESIGN AND OPERATION

5.A) SITE WATER USE AND MANAGEMENT

There are several encouraging aspects to the proposed approaches to water management at the Project. In particular, references to reducing consumption to minimize freshwater use, diverting non-contact water, and reusing contact water where possible are certainly positive elements of what is proposed (EIS page 677/4067). However, the current proposal is still an open design with significant withdrawals from, and effluent discharges to, the Clearwater River drainage system. This is, again, not an example of providing "the industry-leading environmental performance" (NexGen corporate website). If it were, the engineering design goal would be based on what is called *Zero Liquid Discharge* (ZLD), something already in use in numerous industrial operations.

If an open water system is to be allowed, then effluent treatment measures should ensure that discharge water quality is at least as high as source water quality, and the intake pipe should be required to be located downstream of the outlet pipe.

Effective impact mitigation strategies start with not creating a problem in the first place, and that can often be facilitated by converting a problem into an opportunity. In the case of sewage effluent, the problem stems from use of conventional flush toilets instead of, for example, urine-separating composting toilets. Greywater is far easier to treat than blackwater, and the solid wastes can be co-composted with food scraps as part of creating an on-site source of material for use in re-establishing vegetation cover during reclamation. Despite the relatively cold regional climate, the opportunity for such co-composting could be facilitated using the heat from the Project's LNG-fired power plant if it is designed and operated as a Combined Heat and Power (CHP) facility.

R.9. *SES recommends that the final EIS include an alternative site water management design based on no degradation of water quality in Patterson Lake.*

5.B) CONVENTIONAL WASTE MANAGEMENT

References to optimizing reuse and recycling, as part of managing the Project's conventional domestic and industrial waste streams, are encouraging. However, the provided details (EIS page 687/4067) describe a management system that is still largely a *burn-the-garbage* approach and uses yet-more LNG to incinerate materials that should be considered resources, not 'waste'. This would certainly not provide "the industry-leading environmental performance" that NexGen refers to on its corporate website. Demonstrating an understanding of sustainability requires making *Zero Waste* the goal. With its headquarters in Vancouver, NexGen will be familiar with the zero waste concept.

Materials like glass and metals are not readily incinerated, while the things that do burn more easily, those of organic origin such as food scraps, paper, and cardboard, are readily recyclable. There is a product stewardship program for used oil that includes both return and processing incentives and eliminates the need to burn it. Of course, scrap wood burns well, but it has value as a heating fuel and could, for example, be donated to residents in communities on the route to the mine, such as La Loche and Buffalo Narrows, who rely on wood as a fuel. Composting all the organic residues on-site would provide the benefit of incorporating their management as an asset in the reclamation program.

The vast majority of all the materials that have already been brought to the Project site, or would be during the construction and operation phases, arrive by road. Except for those used to ship the uranium concentrate, trucks normally arrive loaded and return empty. This provides NexGen with a very significant opportunity to include backhaul of reusable and recyclable materials in their contracts with transport service providers.

R.10. *SES recommends that, in the final EIS, NexGen provides a Conventional Waste Management alternative plan that is based on a Zero Waste goal.*

5.C) POWER SUPPLY AND CAMP FACILITIES

The selected alternative for supplying electricity is an LNG-fired power plant. The Project description also indicates that additional gas will be used for the heating of buildings. Despite the relatively central location of the power plant on the mill terrace, in proximity to buildings such as the main camp, maintenance shop/warehouse, and wash bay, there is no mention of producing both power and space heating from the LNG fuel using cogeneration, also known as Combined Heat and Power (CHP). The use of a CHP design could provide greater efficiency and thereby some reduction of GHG emissions.

R.11. *SES recommends that the final EIS include the alternative of having the power plant built and operated as a CHP facility.*

6. ECOSYSTEM IMPACTS: VEGETATION, FISH AND WILDLIFE

It is evident from the vast amount of information provided in sections 11, 13 and 14 of the EIS that a substantial effort has been made to inventory and evaluate the state of the existing ecosystem and potential for impact. However, several discrepancies and gaps are apparent.

Q.11. *Why was the identification of Valued Components done at the ecosystem level for vegetation, but at the species level for fauna, and limited to such a relatively small selection of terrestrial and aquatic VC species?*

Q.12. *Given their ecological roles, and importance as indicators of ecosystem condition, why were no aquatic or terrestrial invertebrate species identified as VCs?*

Q.13. *Given the importance of their ecological niches, and indicators of ecosystem condition, why were no raptors, fish-eating birds, mustelids, or small rodents selected as VCs?*

7. OTHER LAND AND RESOURCE USE: PARKS AND PROTECTED AREAS

The proposed Project would be the first of what seems likely to be a series of uranium mines in the upper Clearwater River watershed. If approved, it would initiate a substantial intensification, following more than a decade of mineral exploration, of industrial development in the river's headwater reaches.

The Clearwater River and adjacent corridor is of major provincial and national importance in terms of its role in protection of significant natural, recreational, and cultural heritage resources. Clearwater River Provincial Park (CRPP) is one of only two Wilderness Class parks in the Saskatchewan Provincial Park System. The portion of the river from Lloyd Lake to the Alberta border was among the first to be designated under the Canadian Heritage River System (CHRS). With the subsequent additional designation of the portion from the Saskatchewan border to Ft. McMurray, Alberta, the Clearwater is now one of only two interprovincial rivers in the CHRS.

The presence of the CRPP, including both its CHRS designation as well as the presence of the Methye Portage National Historic Site within it, are acknowledged with a very brief overview description (EIS page 3309/4607). However, despite its ecological and cultural heritage importance, the CRPP is neither identified as a Valued Component nor given consideration in terms of potential impacts associated with the Project!

This is difficult to understand since the Project proposes adding industrial emissions and waste effluents into the Clearwater watershed over a prolonged period. Furthermore, the only road by which all the materials can be trucked to/from the mine bisects this Wilderness Park / Heritage River to cross at the Warner Rapids bridge. For example, even just the delivery of LNG for the power plant will require more than 8,700 heavy truck transits through the middle of the Park, *annually*, during the Project's 24-year operational phase. Another potential impact pathway could be through displacement of other resource and land use activities, shifting them away from the mining-related disturbances in the upper portion of the watershed and into the Wilderness Park.

R.12. *SES recommends that the final EIS be required to recognize the Clearwater River Provincial Park and Canadian Heritage River as a Valued Component and include it in monitoring and impact mitigation planning.*

8. ENVIRONMENTAL COMMITTEES AND INDIGENOUS MONITORING

NexGen has committed to establishing and maintaining environmental committees for each Indigenous group. Each committee would consist of two Indigenous representatives and two

NexGen employees. NexGen would also provide funding for a full-time Indigenous Monitor to be chosen by each Indigenous body. This is all good in principle.

A committee with membership split evenly between local residents and company representatives may find decision-making difficult, particularly as the company representatives may be more technically experienced than the other members.

R.13. *SES suggests a fairer structure for the Environmental Committees would be two local residents, one company representative, and one independent, outside advisor to be selected by the other three. We recommend that such an alternative structure be considered.*

The following questions also arise:

Q.14. *Who will determine how long these Environmental Committees and Monitors will be maintained and funded?*

Q.15. *Will the Committees have funding to conduct independent studies if they feel these are necessary?*

Q.16. *The Indigenous monitor is to be chosen by each Indigenous organization. Will the Indigenous organizations have the option of naming a non-Indigenous person as their monitor if they prefer?*

SUMMARY OF QUESTIONS

Q.1. *How much of the environmental impact 'capacity' in the region should the first or any one developer be allowed to occupy, given that other future projects will also be seeking a share of that finite regional 'capacity'?*

Q.2. *Are there documented examples of deep underground storage of uranium mine tailings? If so, please provide details of their history, including the nature, duration, and results of monitoring.*

Q.3*. What is the expectation for the structural longevity of the concrete/tailings backfill material? (A quick search indicates that concrete generally remains stable for 50 to 100 years, depending on the chemical environment in which it is located.)*

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SUMMARY OF RECOMMENDATIONS

R.1. *SES recommends that evaluation of the justification for, benefits of, and alternatives to the Project be based on a fully comprehensive description of how it might fit within the transition to a sustainable energy future.*

R.2. *SES recommends that NexGen be required to incorporate into the final EIS the implications of its exploration and related pre-mining developments as essential components of the Project.*

R.3. *SES recommends that NexGen be required to incorporate, into the cumulative effects component of the final EIS, the implications of its ongoing and planned additional efforts to expand and extend uranium exploitation activity beyond the Arrow Deposit.*

R.4. *SES recommends that all GHG emissions associated with transport of people and materials to and from the site be included in the Project emissions estimate.*

R.5. *SES recommends that all greenhouse gas emissions associated with production of cement used in the project be included in calculation of project emissions.*

R.6. *SES recommends that emissions associated with the production of LNG used in the project as well as its transportation to the site be included in calculation of project GHG emissions.*

R.7. *SES recommends that Canada now focus on achieving its 2030 GHG emission reduction target, recognising that new, more ambitious reductions will be required after that date.*

R.8. *SES recommends that the final version of the EIS take into account the recent, unexpectedly severe, global impacts of climate change as well as estimating the consequences for the project of extended drought and increased wildfire frequency and intensity.*

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