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THE ARCTIC: SCIENCE, LAW, AND POLICY

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In 1959, Sir Charles Snow (C.P. Snow) delivered a lecture at Cambridge University entitled *The Two Cultures and the Scientific Revolution* in which he identified a duality of cultures.[2] There were the scientists and the humanists—two dimly acquainted cultures that rarely communicated, and when they did it was usually at cross-purposes.[3] One culture was contentedly unknowing and skeptical of science, and the other was marginal to the great social questions of the time.[4] For C.P. Snow, the polarization and lack of communication between the two groups could be fatal to the Western World.[5] The 21st century has also revealed polarized cultures of believers and non-believers, not only in the sense of religion, but also science. This belief and disbelief involves great problems of our time, including climate change. In 2017, shifting political winds pretend to divorce science from processes of human beings making choices that become policy and law.[6] This suggests that the schism of 1959, the C.P. Snow problem, has re-emerged.

The authors of the present article are a legal scholar and a physical scientist who value their respective disciplines and find any retreat from science-based decision-making in law and policy alarming. In this complex world where policy makers and lawyers can only respond to the weal and woe of life informed by science, we advocate a multi-method approach. Drawing on the tools of distinct, yet interrelated disciplines, we illustrate the problem and the stakes in the context of the Arctic.

The stakes are illustrated by Arctic warming, sea ice decline, and wider impacts upon the Northern Hemisphere climate. Unsuccessful attempts to navigate through the Arctic Ocean date back hundreds of years because, over at least the past 2000 years, Arctic temperatures have been too cold[7] to allow more than peripheral melting of sea ice. Since 1979 minimum sea ice extent has been declining at approximately 13% per decade and the Arctic Ocean is emerging as a new waterway for commerce.[8]

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[2] C.P. SNOW, THE TWO CULTURES AND THE SCIENTIFIC REVOLUTION 4 (1959). On a similar theme, *see* Raymond Aron, *The Education of the Citizen in Industrial Society*, 91 DAEDALUS 249, 254-55 (1962).

[3] SNOW, *supra* note 2.

[4] *Id.* at 1-12, 14.

[5] *Id.* at 17, 21.

[6] *See* W. MICHAEL REISMAN & AARON M. SCHREIBER, JURISPRUDENCE: UNDERSTANDING AND SHAPING LAW, 595 (1987).

[7] *See* A. Moberg, D.M. Sonechkin, K. Holmgren, N.M. Datsenko & W. Karlen. *Highly Variable Northern Hemisphere Temperatures Reconstructed from Low- and High-Resolution Proxy Data,* 433 NATURE 613, 613, 616-17 (2005).

[8] *See Scientific Data Search*, NAT'L SNOW & ICE DATABASE, http://nsidc.org/data/search/#keywords=sea+ice/sortKeys=score,,desc/facetFilters=%257B%257D/pageNumber=1/itemsPerPage=25 (last visited Mar. 24, 2017).

Melting sea ice has enhanced human activity including shipping, tourism, oil and gas exploration, and mining. The consequences of cryospheric changes are causing States and non-States to assert more intense claims to Arctic resources, accelerating the prospects of conflicts between and among polar and non-polar States. The social process of the Arctic, "a continuing flow of interaction in which people strive to maximize values affecting resources"[9] is increasingly driven by ice melt. In the Arctic context, science vividly interacts with law and the policies it expresses.

Science has long occupied a role in American legal thought and law-making.[10] On January 17, 1899, when Oliver Wendell Holmes, Jr. was Associate Justice of the Supreme Judicial Court of Massachusetts, he delivered an address to the New York State Bar Association entitled "Law in Science and Science in Law." He observed that,

> [T]he practical study of the law ought also to be scientific. The true science of the law does not consist mainly in a theological working out of dogma or a logical development as in mathematics, or only in a study of it as an anthropological document from the outside; an even more important part consists in the establishment of its postulates from within upon accurately measured social desires instead of tradition. . . . I have had in mind an ultimate dependence upon science because it is finally for science to determine, so far as it can, the relative worth of our different social ends…[11]

Holmes's clarion call was carried into the mid-20th Century jurisprudential movement known as American legal realism. In 1943 writing in the *Yale Law Journal* Hubert Smith observed,

> All rules of substantive law assume the existence of basic facts on which to operate. Let these facts be distorted in their ascertainment, and the result may be as harsh as if defective legal principles were applied to agreed facts. For that reason, one signal aid which science may extend to law lies in the range of what we may call scientific proof. By scientific proof I mean the use of those scientific means and methods calculated to enable the accurate ascertainment of ultimate facts, either as a basis for settling private litigation (evidentiary), or as a means of forming or orienting legal or social policy (jurisprudential). Scientific proof, so conceived, goes to the basis of action…"[12]

For a lawyer, discussion of scientific proof in the ascertainment of fact suggests evidence, "[S]omething that…tends to prove or disprove the existence of an alleged fact."[13] This procedure of using evidence to prove or disprove facts compels the lawyer to think scientifically.

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[9] M. McDougal, W.M. Reisman & A.R. Willard, *The World Community: A Planetary Social Process*, 21 U.C. DAVIS L. REV. 807, 814 (1988); *see generally* HAROLD D. LASSWELL & MYRES MCDOUGAL, JURISPRUDENCE FOR A FREE SOCIETY: STUDIES IN LAW, SCIENCE AND POLICY, VOL. I (1989).
[10] *See generally*, Robert Merges, *The Nature and Necessity of Law in Science*, 38 J. LEGAL EDUC. 315 (1988); Mass. Inst. of Tech., LAW AND SCIENCE Vol. I (Susan S. Silbey ed. Ashgate Publishing 2008), *available at* http://web.mit.edu/ssilbey/www/pdf/Silbey_I_fnl.pdf.
[11] Oliver W. Holmes, *Law in Science and Science in Law*, 4 Harvard L. Rev. 443, 452, 462 (1899).
[12] Hubert W. Smith, *Scientific Proof*, 52 YALE L. J. 586, 586 (1943).
Black's Law Dictionary, 10th ed.

Myres S. McDougal and Harold D. Lasswell observed that "[e]ffective training in scientific thinking requires that students become familiar with the procedures by which facts are established by planned observation. . . . [T]he policy-maker needs to guide his judgment by what is scientifically known and knowable about the causal variables that condition the democratic variables."[14] In 1947 a new course appeared on the fall curriculum at Yale Law School, a seminar in Law, Science, and Policy taught by Professors Harold Lasswell and Myres McDougal described as "Law and science as instruments of public and private policy with reference to selected problems of property and politics."[15] From this emerged the interdisciplinary method of Policy Sciences.[16] A seminal contribution of the Policy Scientists was to illuminate decision-making—how to make rational choices in the common interest informed by social and physical science.[17]

The problems that confront decision-makers—forensics, intellectual property, the environment, continental shelf delimitations, and control of nuclear weapons to name several—make science-based decision-making crucial in clarifying goals, appraising trends and factors, making projections, and devising alternative futures. And numerous scientists and scientific organizations make findings available to decision-makers.[18] We illustrate this through the prism that is the Artic, in the spirit of Holmes' call for "scientific proof as a basis for action."

In the Arctic context, again consider sea ice. Change in the areal extent of sea ice in the Arctic and Antarctic represents one of Earth's greatest seasonal events. When the ocean surface is capped by sea ice it traps ocean heat that would otherwise exchange with the overlying atmosphere. Since sea ice is lighter in color than the ocean surface it can reflect significant amounts of incoming radiation, close to 100% when it is covered with fresh snow. The heat balance associated with sea ice distribution, therefore, exerts a major control on the thermal balance between the polar and mid latitudes that in turn defines the strength and spatial distribution of atmospheric circulation. With a weaker thermal gradient (relative warming of the poles) wind patterns favor more exchange of cold air from the poles and warm air from lower latitudes. This increased juxtaposition of cold and warm air creates greater instability in climate, hence the potential for more extreme weather events. Winds transport not only heat, but also moisture and pollutants, in addition to being a major

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[14] Myres S. McDougal & Harold D. Lasswell, *Legal Education and Public Policy: Professional Training in the Public Interest*, 52 YALE L.J. 203, 214 (1943).

[15] Myres S. McDougal, *The Law School of the Future: From Legal Realism to Policy Science in the World Community*, 56 YALE L.J. 1345, 1352-53 (1947).

[16] *See generally* HAROLD D. LASSWELL, A PRE-VIEW OF POLICY SCIENCES (1971); LASSWELL &. MCDOUGAL, *supra* note 5; *Myres S. McDougal & William T. Burke*, THE PUBLIC ORDER OF THE OCEANS: A CONTEMPORARY INTERNATIONAL LAW OF THE SEA, 1962 (1987, with new introductory essay), Myres S. McDougal, Harold D. Lasswell & Ivan A. Vlasic, LAW AND PUBLIC ORDER IN SPACE (1963); Douglas M. Johnston, THE INTERNATIONAL LAW OF FISHERIES: A FRAMEWORK FOR POLICY-ORIENTED INQUIRIES (1965) (1987, with new introductory essay); Myres S. McDougal, H. Lasswell & James C. Miller, THE INTERPRETATION OF INTERNATIONAL AGREEMENTS AND WORLD PUBLIC ORDER: PRINCIPLES OF CONTENT AND PROCEDURE, (1967) (1994, with new introductory essay). For classic works in the discipline, *see* POLICY SCIENCES, http://www.policysciences.org/ (last visited April 10, 2017).

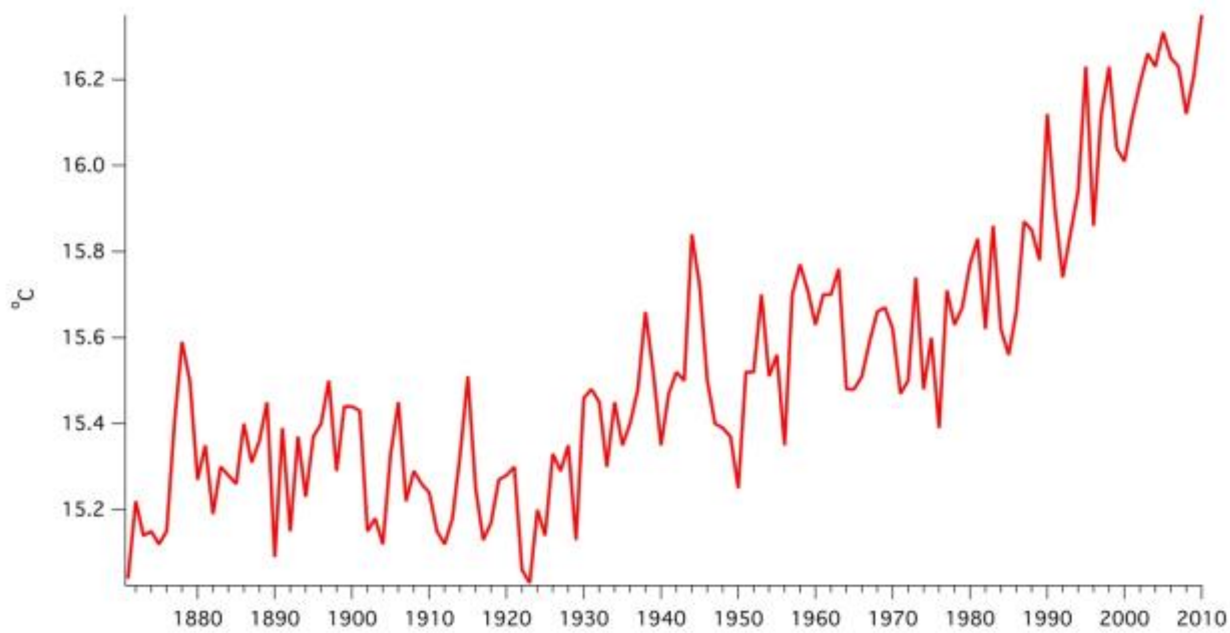
[17] Physical scientists and social scientists draw upon Policy Sciences to understand climate change conditions and implications for law and policy. *See generally,* Ronald D. Brunner and Amanda H. Lynch, ADAPTIVE GOVERNANCE AND CLIMATE CHANGE (AMS Press and University of Chicago Press 2010); Amanda H. Lynch, Mark C. Serreze, Elizabeth N. Cassano, Alex D. Crawford, and Julienne Stroeve *Linkages between Arctic summer circulation regimes and regional sea ice anomalies*. J. GEOPHYS. RES. 121, 7868, 7868-7880 (2013); Amanda H. Lynch and Ronald D. Brunner, *The importance of context in climate change impacts assessment: Lessons from Barrow, Alaska*, 82 CLIMATE CHANGE 1, 93-111 (2007).

[18] For example, the Climate Change Institute of the University of Maine provides expertise on climate-related matters to people and governments world-wide. *See Climate Change Institute*, UNIV. OF ME., http://climatechange.umaine.edu/ (last visited April 10, 2017).

driver of sea surface currents and sea surface temperatures. Therefore, sea ice can exert both local and hemispheric scale climate impacts.

Law and policy informed by science is "[t]o insist on the empirical criterion is to specify that general assertions are subject to the discipline of careful observation. This is a fundamental distinction between science and non-science."[19] For the lawyer, that assumes the standpoint of a systematic contextualist who is also empirical and at a minimum capable of appraising empirical data—evidence—for the decision-process. This "… policy sciences viewpoint—contextual, problem-oriented, multi-method—is a move away from fragmentation."[20]

The starting point of every decision process is the intelligence function which entails gathering, processing, and dissemination of information. What intelligence does any key Arctic decision-maker require? Key rubrics are air temperature, sea ice, and climate. The problem is clarified by understanding that Northern Hemisphere mean annual air temperature has been on the rise for much of the 20th and now into the 21st century, paralleling greenhouse gas rise, with the most dramatic rise since the 1980s (see figure 1 below).



(Figure 1)[21]

Comparison of the temperature difference between the period 2000 to 2015, and the period 1979 to 1999 (see figure 2 below) demonstrates that the greatest warming over this period, in excess of 1°C, has been in the mid to high latitudes of the Northern Hemisphere. [22]

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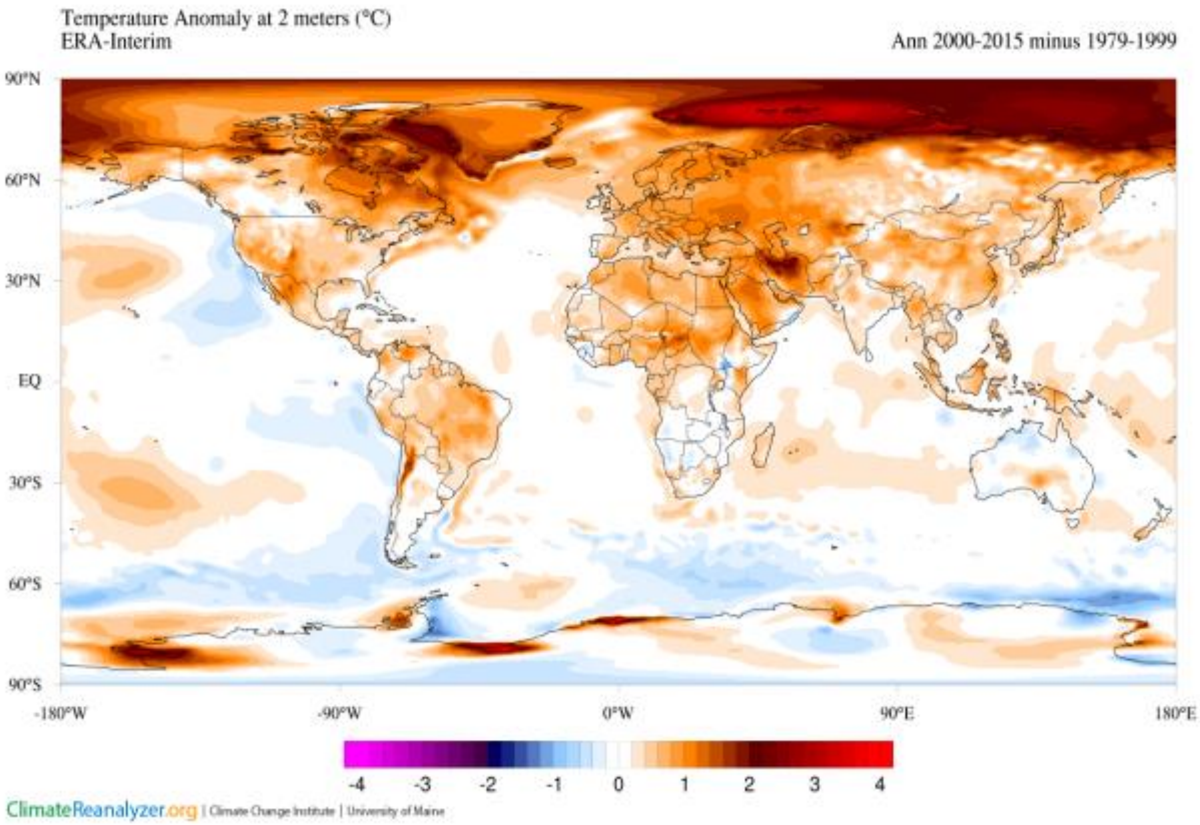
[19] Harold D. Lasswell, A PRE-VIEW OF POLICY SCIENCES 1 (1971).
[20] *Id at xiii.*
[21] Figure 1 – NOAA/CIRES 20th Century Reanalysis V2 Northern Hemisphere annual temperature at 2m above the surface.
[22] P.A. Mayewski, S.B. Sneed, S.D. Birkel, A.V. Kurbatov, & Maasch, *Holocene Warming Marked by Longer Summers and Reduced Storm Frequency Around Greenland*, 267 J. OF QUATERNARY SCIENCE, 8179 (2013).



(Figure 2)[23]

The greatest warming in the Northern Hemisphere for the same comparison period (see figure 2 above) has been in the Arctic, with the eastern Arctic registering as much as 4°C over just this short comparison period.

Over the eastern Arctic the summer season doubled in length for the period 2007 to 2012 compared to 1979 to 2000.[24] Comparison of the foregoing with ice core reconstructed, past climate change demonstrates that the magnitude and timing, but not the areal extent of this warming is equivalent to the abrupt climate change event that heralded the transition in climate ~11,500 years ago from the last vestiges of the ice age to modern climate. [25] Recent warming and Arctic sea ice decline is therefore not just part of the natural variability of the climate system, it is instead a new era in the climate system forced largely by human activity. A decision-maker must understand these trends because they disclose the discrepancies between preference and fact that policy must address.

The trends evolve owing to factors shaping conditions that can be scientifically identified and analyzed. Arctic sea ice extent is inextricably associated with air and sea surface temperatures and as such peripheral sea ice margins respond most sensitively (see figures 3 and 4 below).

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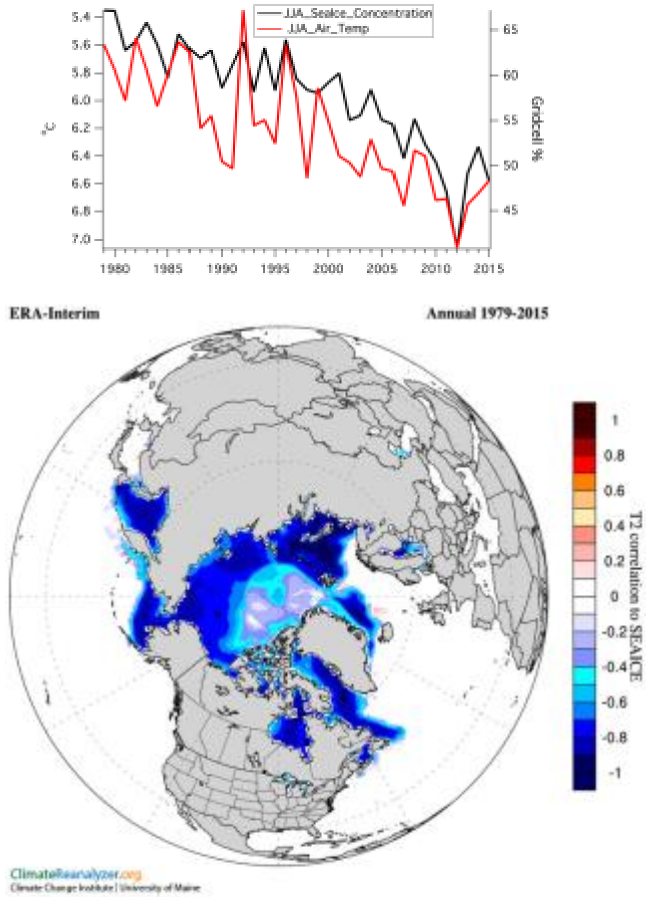
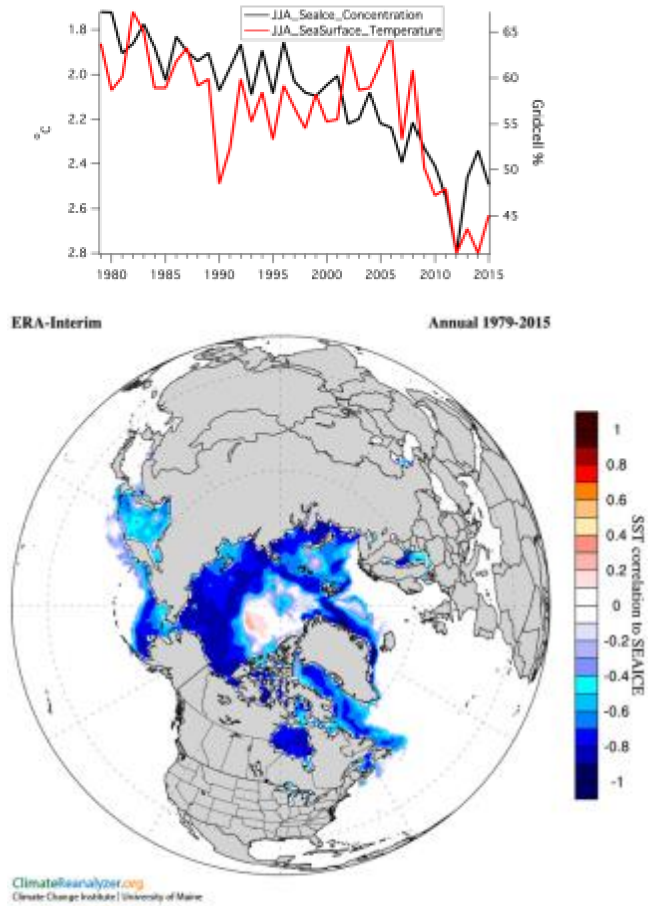
[23] Figure 2 – Difference in mean annual temperature at 2m above the surface for the period 2000 to 2015 minus the period 1979 to 1999 based on ERA-Interim climate reanalysis data. Plotted using Climate Reanalyzer™.
[24] *Id.*
[25] *Id.*



(Figure 3)[26]

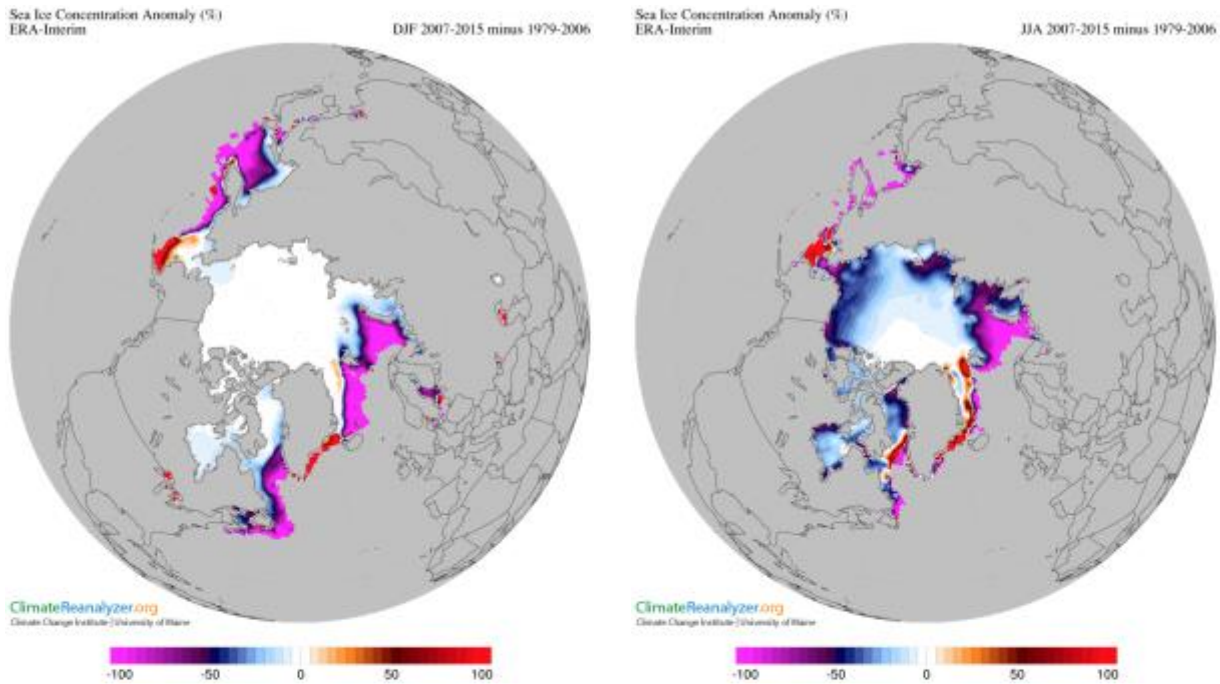
[26] Figure 3 – Upper – comparison of sea ice concentration (gridcell %) versus air temperature (2m above the surface in ºC) for June-July-August (JJA) 1979-2015 using ERA-Interim climate reanalysis. Lower – Spatial correlation between mean annual temperature (T2 at 2m above the surface in ºC) and sea ice concentration (SEAICE) over the period 1979-2015 using ERA-Interim climate reanalysis. Plotted using Climate Reanalyzer™.



(Figure 4)[27]

Therefore, Arctic warming has resulted in massive, regional scale losses of sea ice in both winter and summer (see figure 5 below).

[27] Figure 4 – Upper – comparison of sea ice concentration (gridcell %) versus sea surface temperature (in ºC) for June-July-August (JJA) 1979-2015 using ERA-Interim climate reanalysis. Lower – Spatial correlation between sea surface temperature (SST in ºC) and sea ice concentration (SEAICE) over the period 1979-2015 using ERA-Interim climate reanalysis. Plotted using Climate Reanalyzer™.



(Figure 5)[28]

To a significantly lesser extent, sea ice is increasing in some regions even in a warming Arctic. This can occur where freshwater emerging from melting glaciers, promotes the freezing of sea ice at higher temperatures than freezing in salt water and/or where winds push sea ice seaward creating leads (cracks) that freeze and expand sea ice area (see figure 5 above).[29]

Arctic warming and attendant sea ice decline have far reaching consequences for the climate of the Northern Hemisphere. The westerly flowing air that comprises the jet stream is getting wavier with Arctic warming as the thermal gradient between the Arctic and mid latitudes weakens.[30] A wavier jet stream leads to greater persistence in seasonal patterns and an increased frequency of extreme events[31] resulting in increased variability and instability in climate. Examples of the foregoing include: (1) persistent drought in the western United States; (2) dramatic seasonal temperature extremes in the eastern United States (see figure 6 below for an

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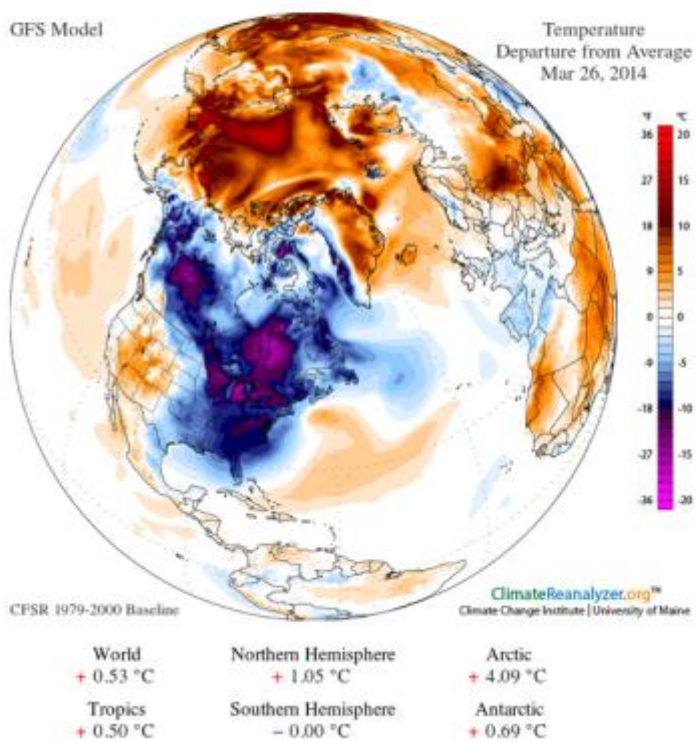
[28] Figure 5 – Difference in sea ice concentration (gridcell %) between the period 2007-2015 minus the period 1979-2006 using ERA-Interim climate reanalysis data. Left - December-January-February (DJF, winter). Right – June-July-August (JJA, summer). Plotted using Climate Reanalyzer™.

[29] *Id.*

[30] Jennifer A. Francis & Stephen J. Vavrus, *Evidence of a wavier jet stream in response to rapid Arctic warming*, 10 ENVIRON. RES. LETT. 1, 8-9 (2015).

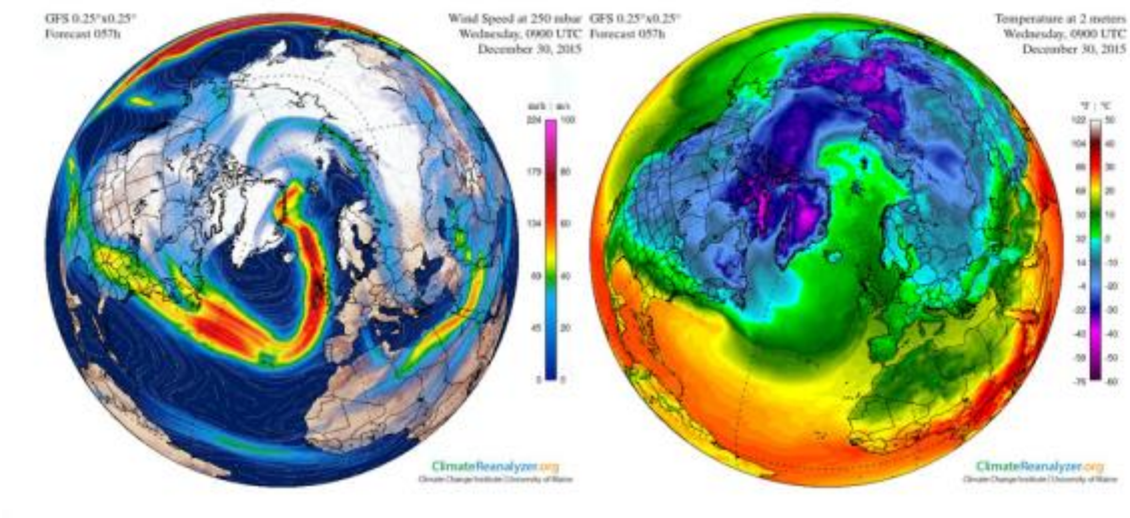
[31] *Id.* at 1.

example of the March 2014 cold wave in the midst of Northern Hemisphere warming); and (3) extreme warming over the Arctic (see figure 7 below for an example of above freezing temperatures at the North Pole in late December 2015 as a consequence of a highly embayed (wavy) jet stream pattern).



(Figure 6)[32]

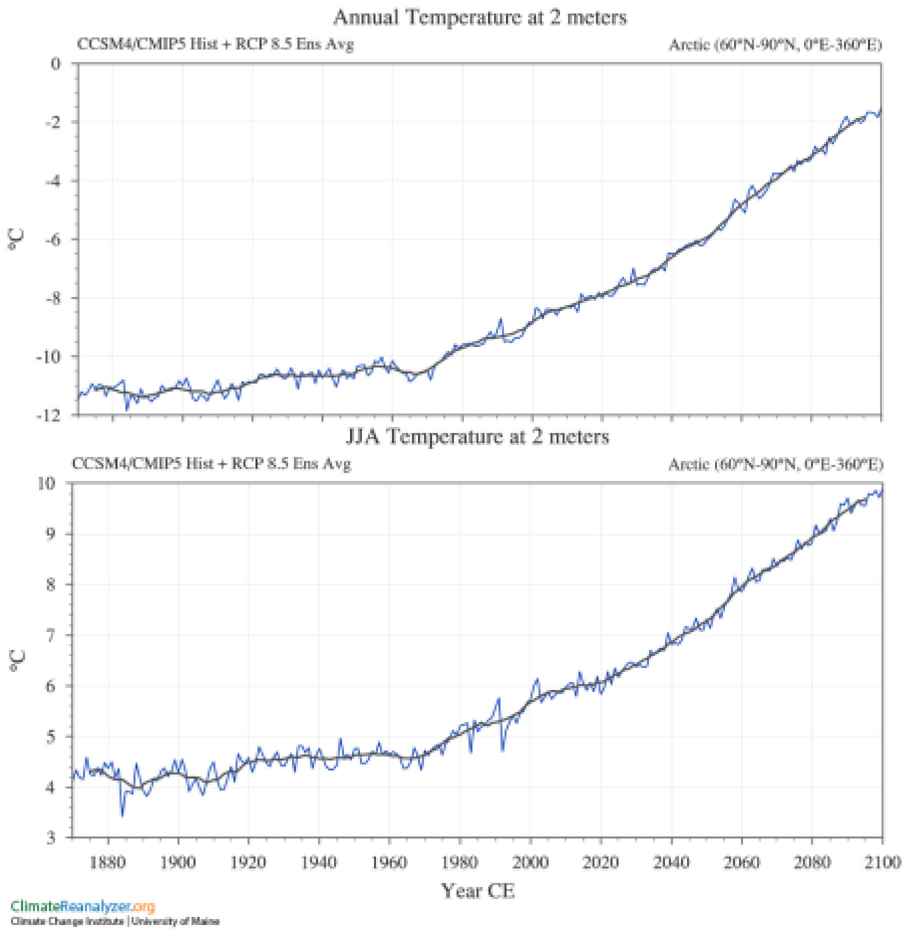
[32] Figure 6 - temperature departure from average (1979-2000 baseline) for much of the Northern Hemisphere. This is a typical day for winter 2014-2015. While eastern and notably northeastern US are unseasonably cold, the rest of the Northern Hemisphere is unseasonably warm and the Arctic is dramatically warmer. Greenhouse gas warming has impacted the pattern of the jet stream that divides cold and warm air. Data plotted using the Climate Change Institute Climate Reanalyzer™.



(Figure 7)[33]

Projections for future Arctic climate change based on global circulation models, such as those used by the Intergovernmental Panel on Climate Change (IPCC) are driven by a combination of natural and human source controls. These models suggest that Arctic warming will increase significantly, yielding a nearly year-round ice free Arctic Ocean by the end of the 21st century with a mean annual Arctic temperature rise of up to 8°C and Arctic summer temperatures close to two times present (see figure 8 below).

[33] Figure 7 – Left - wind speed aloft in the atmosphere revealing the pattern of the jet stream and right – temperature at 2m above the surface demonstrating how a wavy jet stream provides access for warm air into the Arctic (extreme example December 30, 2015). Data plotted using the Climate Change Institute Climate Reanalyzer™.



(Figure 8)[34]

While these models offer valuable insight into the trajectory for Arctic climate change, they are based primarily on projections for future carbon dioxide emissions and they assume linear change in climate—they are therefore only a conservative estimate of future climate. There is little doubt of the increasing trajectory in Arctic temperature, but there are more aspects to consider than those embodied in these models. Arctic warming is already leading to the release of methane, a greenhouse gas that is at least 30 times more effective in heat trapping than carbon dioxide; the reality of recent abrupt Arctic warming demonstrates that linear model projections are not sufficient to describe the rate of future Arctic and, for that matter, globally distributed climate change.

Finally, Arctic warming poses current and future challenges in the form of: (1) sea level rise associated with the ongoing melting of Arctic glaciers, notably the Greenland ice sheet, and, with sea level rise, continued introduction of freshwater into the Arctic Ocean and surrounding oceans leading to changes in ocean circulation and salinity with impacts on marine ecosystems; (2) continued instability in the timing, frequency, and magnitude of extreme events resulting from thermal gradient driven changes in atmospheric circulation systems with attendant redistribution

[34] Figure 8 – Arctic temperature change derived from a combination of IPCC utilized global climate models (CCSM4 and CMIP5) that include natural and human source climate forcing. Top – annual Arctic temperature at 2m above the surface. Bottom – JJA (June July-August) mean temperature at 2m above the surface. Data plotted using the Climate Change Institute Climate Reanalyzer™.

of heat and moisture that can yield drought/flood, and changes in snow cover and seasonal timing of precipitation; (3) glacier melt leading to the release of decades of pollutants with water resource and ecosystem impacts; and (4) glacier disintegration leading to changes in the distribution and density of icebergs with marine navigation impacts. Given these projections, the law and policy tasks are to devise mechanisms and instruments aimed at achieving a preferred future.

As policy scientists have demonstrated, decision-making is not a single act.[35] It comprises distinct functions and scientific facts integral to the foundational function of intelligence that may lead to the formation, application and, possibly, termination of prescriptions. Reliable scientific trend data and isolated conditioning factors enable projections. The Artic projection indicated by the IPCC, noted above, is a conservative appraisal. In fact, we must prepare for a more dire Arctic future.[36] Dismal projections informed by science may enable decision-makers to design programs and mechanisms to achieve a preferred future. In the Arctic context, prescriptions have been devised to respond to and accommodate the abrupt climate change and consequences described by scientists. These include the Polar Code, OSPAR, and international legal instruments shepherded by the Arctic Council. These instruments are outcomes of science-driven policy.

Arctic scientific cooperation is not new. "Some of the most compelling examples of scientific cooperation in the Arctic have been the diverse scientific activities conducted under the banner of the International Polar Year ("IPY") on four occasions during the past 125 years."[37] Science-based international legal instruments have been demonstrably effective.[38] For example scientific cooperation is the cornerstone of the highly effective Antarctic Treaty.[39] Antarctica is a continent surrounded by water while the Arctic is an ocean surrounded by five coastal States which exercise maritime zonal jurisdiction. However, the Central Arctic Ocean extends beyond the national jurisdiction of any state and is a challenge for ecosystem management. Hence scientists, lawyers, and diplomats are working through a United Nations committee to achieve a legal instrument to protect biodiversity of areas beyond national jurisdiction with the key goal of protecting the Central Arctic Ocean.

In the previous *Ocean and Coastal Law Journal* Arctic Symposium issue, one of us asked "…how the Arctic constitutive process, driven by an ever-intensifying process of claims, will evolve in a context shaped by new cryospheric conditions that include abrupt climate change."[40]

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[35] See W. Michael Reisman, *The View From the New Haven School of International Law*, 86 AM. SOC'Y L. PROC. 118 (1992); Andrew R. Willard & Charles H. Norchi, *The Decision Seminar as an Instrument of Power and Enlightenment*, 14 INT'L SOC'Y POL. PSYCHOL. 575 (1993).

[36] Henry Fountain, *Arctic's Winter Sea Ice Drops to its Lowest Recorded Level*, N.Y. TIMES (Mar. 22, 2017), https://www.nytimes.com/2017/03/22/climate/arctic-winter-sea-ice-record-low-global-warming.html?_r=0.

[37] Karen Kraft Sloan & David Hik, *International Polar Year as a Catalyst for Sustaining Arctic Research,* 8 Sustainable Dev. L. & Pol'y 4, 4 (Spring 2008).

[38] Among these are the Antarctic Treaty; The United Nations Framework Convention on Climate Change; The Kyoto Protocol to the United Nations Framework Convention on Climate Change; The United Nations Convention on the Law of the Sea, Art. 192, 193, 194,195, 196, 204, 206, 207; and the Montreal Protocol on Substances that Deplete the Ozone Layer. According to Dr. Paul Mayewski, the Montreal Protocol began the process of closing a hole in the ozone layer caused by ozone-depleting chemicals found in a wide array of consumer products at the time hence the ozone layer is in the process of recovering thanks to the Montreal Agreement. *See* Laura Poppock, *Twelve Years Ago, the Kyoto Protocol Set the Stage for Global Climate Change Policy*, SMITHSONIAN (February 17, 2017) http://www.smithsonianmag.com/science-nature/twelve-years-ago-kyoto-protocol-set-stage-global-climate-change-policy-180962229/, https://perma.cc/UCU6-B34T.

[39] The 1959 Antarctic Treaty stabilized claims to the Antarctic and established scientific cooperation which continues. *See The Antarctic Treaty,* SECRETARIAT OF THE ANTARCTIC TREATY, (last visited Apr. 4, 2017) http://www.ats.aq/e/ats.htm.

[40] Charles Norchi, *The Arctic in the Public Order of the World Community*, 22 OCEAN & COASTAL L.J. 5, 16 (2017).

Beginning with the five Arctic group of States littoral to the Arctic Ocean, (A5) institutions are increasingly at the center of the Arctic constitutive process. This includes the architecture of the United Nations Convention on Law of the Sea (UNCLOS), the International Maritime Organization (IMO), the Barents Euro-Arctic Council, the Nordic Council, NATO, and the Arctic Council. These institutions project policy, prescribe standards, and their member States apply law that depends upon Arctic science. The IMO relied upon sea ice appraisal in devising the Polar Code that came into force a few weeks ago. The Arctic Council is driven by important working groups that include scientists such as the Scientific Cooperation Task Force (SCTF), the Protection of the Marine Environment (PAME) group, and the Arctic Monitoring and Assessment Programme (AMAP).[41] The institutional commitment of the council (and member States) to science-based decision-making is evident in the Arctic Climate Impact Assessment (ACIA) launched in 2004 which challenged the idea of the Arctic as frozen desert.[42]

The United States is in its final year as chair of the Arctic Council. The 2015-2017 Arctic Council work plan includes initiatives on maritime ocean safety, security, improving conditions of Arctic peoples, and addressing impacts of climate change. A U.S. priority has been the Scientific Cooperation Task Force (SCTF) which has been working on arrangements to improve scientific research cooperation among the eight member States.[43] Concerns have been access to data, access to scientific infrastructure and research, and ease of movement of scientists. The SCTF has nearly completed an Agreement on Enhanced International Arctic Scientific Cooperation to be open for signature in May 2017 at the conclusion of the U.S. Chairmanship.[44] The task force co-chair, Evan Bloom, has stated, "[t]he new agreement, which will be the third legally-binding agreement under the auspices of the Arctic Council, will help facilitate cooperation on science in the Arctic, and remove obstacles to that cooperation."[45] This is a prime example of science-driven policy maturing as an international legal instrument. However, the legal character of the agreement under American law in a time of climate-science skepticism could render the agreement pathological. Under U.S. law, international agreements fall into three categories: treaties, congressional executive agreements, and sole executive agreements. The President can unilaterally withdraw from the latter and can unwind congressional executive agreements with congressional cooperation. We hope the new American administration will understand that the Agreement on Enhanced International Arctic Scientific Cooperation is in the continuing interest of the United States.[46]

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[41] *See Working Groups*, ARCTIC COUNCIL (Sep. 10, 2015), http://www.arctic-council.org/index.php/en/about-us/working-groups.

[42] Among the important scientific contributions of the Arctic Council is the *Arctic Resilience Assessment* (ARA) led by the Stockholm Environment Institute and the Stockholm Resilience Centre produced in collaboration with Arctic countries, indigenous peoples and Arctic scientific organizations. ARCTIC RESILIENCE REPORT, ARCTIC COUNCIL, *available at* http://www.arctic-council.org/arr (last visited April 29, 2017).

[43] The SCTF was established at the Kiruna, Sweden Ministerial meeting in May 2013 "to work towards an arrangement on improved scientific research cooperation" among Arctic nations. *See Scientific Cooperation Take Force*, ARCTIC COUNCIL, https://oaarchive.arctic-council.org/handle/11374/77 (last visited Apr. 4 2017).

[44] The agreement is expected to be formally signed by foreign ministers of Canada, Denmark, Finland, Iceland, Norway, Russia Sweden and the U.S. at the Arctic Council Ministerial Meeting in spring 2017 in Fairbanks, Alaska. *See* ARCTIC COUNCIL, FINAL PROVISIONAL AGENDA SAO PLENARY MEETING, JUNEAU AK, MARCH 8 – 9, 2017, 12-13(2017), https://oaarchive.arctic-council.org/bitstream/handle/11374/1901/EDOCS-4034-v9A-ACSAOUS204_JUNEAU_2017_Plenary_Agenda.PDF?sequence=1&isAllowed=y.

[45] *Task Force on Scientific Cooperation meets in Ottawa*, NATIONTALK (July 12, 2016) http://nationtalk.ca/story/task-force-on-scientific-cooperation-meets-in-ottawa.

[46] Cause for concern is expressed in *a New York Times* editorial, *The Trump Administration's War on Science*, N.Y. TIMES, Mar. 27, 2017, at A8, *available at* https://www.nytimes.com/2017/03/27/opinion/the-trump-administrations-war-on-science.html.

Harold Lasswell, writing in 1970, observed that physical scientists and their colleagues "…are concerned about the social consequences and policy implications of knowledge. They are reaching across disciplinary lines to consult and work with specialists on government, law, and politics."[47] This has spawned relationships between science, law, and policy in which scientific facts are the basis of decision-making for law and policy. Yet an alarming trend is the emergence of authoritative decision-makers who retreat from objective scientific fact. Will the year 2017 be remembered for regression to the C.P. Snow problem of "Two Cultures"—the unbridgeable separation between scientists and non-scientists, the will-full ignorance that Snow perceived fatal to the Western World? For an Arctic in the throes of abrupt climate change, any prospect of salvation will lie in the multi-method embrace of science, law, and policy in the common interest.[48]

[47] HAROLD D. LASWELL, A PRE-VIEW OF POLICY SCIENCES xiii (1971).
[48] In his *Encyclical on Climate Change & Inequality*, Pope Francis declared the climate "…is a common good, belonging to all and meant for all." POPE FRANCIS, ENCYCLICAL ON CLIMATE CHANGE AND INEQUALITY: ON CARE FOR OUR COMMON HOME 18 (2015).