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ARTICLES

SATELLITE REMOTE SENSING AND DATABASE MANAGEMENT: WHO OWNS THE DIGITIZED INFORMATION RELATING TO INDIGENOUS PEOPLE AND THEIR ARTIFACTS?

BY BRENDA REDDIX-SMALLS*

I. INTRODUCTION

Recently, two scientists used Google Earth satellite imagery to estimate the area of the fields and the size of the village of a remote tribe in Lowland South America, surrounding the Amazon Basin.[1] This is reportedly one of the last indigenous societies experiencing limited contact with the outside world.[2] The remote surveillance is purportedly the only method used to track such un-contacted indigenous societies.[3]

Is this obtained information a cultural or tribal property interest? Do indigenous peoples, antiquities, their farming methods, their building efforts, and their migratory patterns belong to Google's database, or solely to the universities?[4] Is there an ethical clarion to apply the appropriated

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1. Robert S. Walker & Marcus J. Hamilton, *Amazonian Societies on the Brink of Extinction*, 26 AM. J. HUM. BIOLOGY 570, 570–72 (2014).

2. *Id.* at 570.

3. *Id.* (The following is excerpted from the summary of the report, detailing objectives, methods results and conclusions of the authors' study: "Greater Amazonia harbors as many as 100 locations of isolated indigenous peoples. Few options are available to assess the demographic health of these populations given their limited contact with the outside world. Remote Sensing offers one option . . . . An isolated village in Brazil near the Peruvian border is visible with Google Earth imagery from 2006. The area of the fields and villages, as well as the living area of the other four longhouses, are measured and compared to population by area measurements for 71 other Brazilian indigenous communities . . . . The estimated population of the village is no more than 40 people. A village as small as this one, if it has become disconnected from a metapopulation, risks imminent extinction if it has fallen below a minimum viable population size . . . . An active remote surveillance program is urgently needed to track the movements and demographic health of isolate peoples in hopes of improving their dire chances for long term survival. They need protected areas that are large enough to mitigate against external threats.").

4. *See* Kelly M. Zullo, Note, *The Need to Clarify the Status of Property Rights in International Space Law*, 90 GEO. L.J. 2413, 2434–36 (2002) (arguing that all states benefit from satellite remote sensing data, which is used for purposes such as protecting the environment, forecasting the weather, and providing valuable communications and thousands of employment opportunities throughout the world. Further she argues that commercial enterprises bear the risks and are discovering ways to exploit

knowledge gained through technological non-consensual intrusions to the indigenous people?[5] Is there a human right involved in the remote viewing of the day-to-day activities of people separated by cultural differences?

This article will address indigenous knowledge, settlements, and how the current intellectual property laws[6] and the use of technology data collection[7] have evolved and helped to displace property identities of black, African, Natives[8] and Hispanics in the Americas.[9] I propose to examine the

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natural resources in space profitably, but need a legal regime which can provide certainty in their investments).

5. The author recently attended a Native American cultural powwow from May 2 to May 4, 2014 with the Lumbee Tribe. The author observed the utilization of group cultural normative activities which are appropriated by tribal ownership. Such tribal activities seem ill-fitted to the current copyright regime — in costume, dance, language, and art.

6. Michael J. Huft, *Indigenous Peoples and Drug Discovery Research: A Question of Intellectual Property Rights*, 89 NW. U. L. REV. 1678, 1729 (1995). ("Even as the rapid depletion of much of the world's biological diversity, particularly in the tropics, is becoming a major item of public awareness, the great potential of that diversity for food, medicines, and other products yet undreamed of is only beginning to be understood. Thus the importance of biological conservation now has an economic, as well as an aesthetic and scientific, importance. At the same time, a second issue affecting biological diversity has gained importance .... This issue is the realization that indigenous peoples around the world have developed a profound and extensive knowledge of the uses of the biological resources in their environment and that their knowledge is of inestimable value to Western interests in developing those resources for use in modern society."). *See also* Leo B. Malagar & Marlo Apalisok Magdoza-Malagar, *International Law of Outer Space and the Protection of Intellectual Property Rights*, 17 B.U. INT'L L.J. 311, 348–53 (discussing intellectual property rights in remote sensing activities in outer space).

7. Alexandra Rengel, *Privacy Invading Technologies and Recommendations For Designing a Better Future for Privacy Rights*, 8 INTERCULTURAL HUM. RT. L. REV. 177, 184, 186–87 (2013) ("Three relatively recent major digital developments have affected our concept of privacy greatly: (1) the increase in data creation and the resulting collection of vast amounts of personal data — caused by the electronic recording of almost every transaction; (2) the globalization of the data market and the ability of anyone to collate and examine this data; and (3) the lack of the types of control mechanisms for digital data that existed to protect analog data." More troublesome from the vantage point of disadvantaged citizenry is the use of biometrics: "[t]he operation of collecting, synthesizing and subsequently storing data relating to a particular individual's characteristics — physical, genetic or otherwise — for identification purposes ...." Various forms of biometric technology are being used worldwide in such places as government agencies, education centers, police departments, automated bank devices and retail establishments." The use of this biometric information could pose a problem for socio-economic disadvantage citizens, without access and knowledge.).

8. Huft, *supra* note 6, at 1730 ("[A] consideration of the social and political context in which indigenous knowledge contributes to drug development makes it obvious that while intellectual property rights may at some times be a serious consideration in the use of indigenous knowledge, these rights are unavailable for other types of collaboration. From an equitable viewpoint, however, these other types of collaboration may also deserve some type of return of benefits to the indigenous peoples whose knowledge is used.").

9. Paul G. Lauren, THE EVOLUTION OF INTERNATIONAL HUMAN RIGHTS: VISIONS SEEN 38 (Univ. of Pa. Press 1998) ("But what began to emerge during the sixteenth century with the first shipments of black Africans to the western Hemisphere eventually profoundly altered patterns of slavery. In terms of numbers totaling in the millions, systematic focus on one particular race, creation of an ideology extolling racial superiority and a practice establishing racial segregation between masters and slaves, lucrative financial rewards, and impact on four continents, black slavery had no parallel in history. Few wanted to be left out of this enterprise and thus deny themselves either the power or the profits that

technology that allows Google Earth to map and identify hidden indigenous people, their artifacts, buildings, and cultural and geophysical property location; and to examine the ethical obligations in utilizing such database information.

II. DESCRIPTION, APPLICATIONS, AND VARIOUS FORMS OF REMOTE SENSING TECHNOLOGY

A. An Introduction to Remote Sensing

"Satellite remote sensing visualizes the confluence of human history and the environment,"[10] and has continued to develop since the early twentieth century.[11] The specific term "satellite remote sensing" refers to applying space imagery to archaeological surveys, while searching ancient sites on a specific landscape at different scales.[12] Geographic Information Systems (GIS) and satellite imagery analysis are forms of remote sensing.[13] "'[R]emote sensing' is a term that refers to the remote viewing of [the] surrounding world, including all forms of photography, video[,] and other forms of visualization."[14] Remote sensing involves the human observation of existing landscapes, and is as ancient as the existence of human culture.[15] Satellite remote sensing allows the scholar "to see an entire landscape at different resolutions and scales on varying satellite imagery datasets," and to "record data beyond the visible part of [the] electromagnetic spectrum."[16]

Remote sensing activities allow humans to qualitatively and quantitatively examine images in order to identify and study objects.[17] Remote sensing technologies can measure electromagnetic energy from distant targets, which enables the viewer to extract information about features and objects

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flowed from it. For this reason, and up to the beginning of the nineteenth century, the international slave trade flourished and human bondage in slavery was legally practiced in most countries of the world.").

10. SARAH H. PARCAK, SATELLITE REMOTE SENSING FOR ARCHAEOLOGY 6 (Routledge, 2009). The author is deeply indebted to Parcak's work on Satellite Remote Sensing for Archaeology.

11. *Id.* at 13.

12. *Id.* at 1–3.

13. *Id.*

14. *Id.*

15. *See id.* at 13 (explaining that hunter-gatherer societies engage in remote sensing when using landmarks such as mountains, cliffs, mounds, and far off forests to identify hunting, trapping, and living locations. "Many ancient cultures used mountain peaks or desert cliffs to survey their landscapes prior to choosing the most advantageous positions for their temples, tombs, settlements, or other building projects . . . . They focused on the natural relationship of landscape features to potential places for living burial or worship.").

16. *Id.*

17. SATELLITE REMOTE SENSING: A NEW TOOL FOR ARCHAEOLOGY 3, 7 (Rosa Lasaponara et al. eds., 2012).

on the Earth's land surface.[18] In viewing these multi-spectral images, an observer sees pixels.[19] "[E]ach pixel has a set of spectral values, [that] can be represented as a vector in a multi-dimensional space whose axes correspond to the given image band in the multi-spectral image space."[20] Therefore, spectral images make it possible to categorize various surfaces, materials, structures, and landmarks based on their identifying characteristics. [21]

"The different spectral responses observed for diverse materials according to their characteristics, is generally known as spectral signatures."[22] The pertinent inquiry is: to whom do the spectral signatures identified as humans belong?[23] This question is especially relevant where scientists are identifying and storing knowledge of extant human societies, rather than studying ancient buried artifacts. Where the indigenous societies do not give consent for either observation or data storage, does remote satellite viewing infringe on the human rights or the intellectual property rights of the people there?

B. Applications of Remote Sensing Technologies

Observers routinely use knowledge, experience, and cultural perspectives to gain entry into indigenous communities in order to preserve, exploit, examine, record, and identify different aspects of the culture.[24] This information, in the form of spectral signatures, then becomes data that is stored, analyzed, interpreted, and modified by commercial entities.[25]

Visual identification and data analysis is cheap, simple, and can be completed when features or objects are not easily identifiable.[26] As a limitation, visual interpretation of surface area must be conducted in small confined areas.[27] The advancement of technology for remote viewing data analysis

18. *Id.* at 66 (The "interpretation of geospatial data is possible because objects made of diverse materials emit and/or reflect a different quantity of energy in diverse regions of the electromagnetic spectrum.").

19. *Id.*

20. *Id.*

21. *Id.*

22. *Id.*

23. Mary G. Leary, *The Missed Opportunity of United States v. Jones: Commercial Erosion of Fourth Amendment Protection in a Post-Google Earth World*, 15 U. PA. J. CONST. L. 331, 365 (2012) ("The problem is really who *owns* a person's 'digital dossier' or 'digital identity' [. . .] Palfrey and Gasser describe it as all of the personally identifiable digital information associated with one's name, and they further discuss one's digital identity as a subset of information 'composed of all those data elements that are disclosed online to third parties, whether it is by [one's] choice or not'"). *See also*, JOHN PALFREY & URS GASSER, BORN DIGITAL: UNDERSTANDING THE FIRST GENERATION OF DIGITAL NATIVES 40 (Basic Books, 2008).

24. Lasaponara, *supra* note 17, at 7–8.

25. *Id.* at 11–14.

26. *Id.* at 8.

27. *Id.*

provides expansive improvements.[28] The utilization of computers and data analysis can provide the observer with sufficiently large data sets to enable quantitative analyses of information. These technological advances allow scientists to more easily extract and interpret data for large areas.[29] Currently, technology in remote sensing allows the data to be compiled in a digital format for subsequent digital processing.[30] As some scholars have observed:

> Compared to visual data inspection, digital processing offers several advantages such as, the possibility to: (i) perform repetitive and cost effective data analyses for large areas of cultural interest, (ii) obtain consistent results based on "objective" instead of subjective evaluations, (iii) facilitate the integration of imagery with other data source[s] (archaeological record, documentary sources, etc.), (iv) explore alternative data processing methods and (v) if required, also to apply complex algorithms to make archaeological information extraction and interpretation easier.[31]

Remote sensing specialists may utilize balloons, kites, drones, satellite imagery, or aerial photographs to accumulate data.[32] Mapping products that feature satellite imagery typically combine three dimensional buildings and terrains in high resolution images.[33] Before this technology was commercialized, only military analysts, academics, and spies had access to satellite images.[34] Currently, worldwide public access to satellite images is available via the Internet to almost anyone with computer access.[35]

To understand the evolving scientific use of satellite remote sensing, one must begin with the history of wartime aerial satellite photography, and its use in archaeology. (See appendix for informational access to the commercial satellite imagery sources.)[36]

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28. *Id.*
29. *Id.*
30. *Id.*
31. *Id.* at 8–9.
32. Parcak, *supra* note 10, at 13.
33. Brian Craig, *Online Satellite and Aerial Images: Until the Dawn of the Millennia, Issues and Analysis*, 83 N.D. L. REV. 547 (2007).
34. *Id.* at 548.
35. *Id.* at 547–48 ("Since 1972, the private satellite industry continued to grow and expand. According to the Satellite Industry Association (SIA), the premier trade organization representing the global commercial satellite industry, the 2005 total worldwide satellite industry exceeded $88 billion in revenues with $52.8 billion in revenues derived from satellite services such as satellite imagery.").
36. Parcak, *supra* note 10, at 13.

C. *Various Forms of Remote Sensing Technology*

1. Aerial Photography

It is possible that military photographs taken by pilots in World War I initiated the era of technical remote sensing.[37] In early 1906, a British army pilot took aerial photographs, and introduced the use of aerial remote sensing for archaeological purposes.[38] From the 1920s through the 1930s, aerial photography was used for archaeological purposes by the German Air Forcem Bavaria and the Royal Air Force.[39] "Archaeologists also used early aerial photography for archaeological site management and protection, during World War II, while German, American, and British armed forces photographed a majority of Europe for military reconnaissance purposes."[40]

After World War II, aerial photography utilized infrared technology, and expanded rapidly with reconnaissance of Europe, the Middle East, and the Far East.[41] "Advances in spatial remote sensing from the mid-1940s to the 1950s occurred with the V2 rocket launching scheme in New Mexico, at the White Sands Proving Ground . . . ."[42] Notwithstanding the lack of clarity in these photographs, the value of remote sensing imagery from space became well-established.[43]

In the 1960s, satellite usage intensified in the United States based on increased government funding after the Soviet Union's Sputnik launch in 1957.[44] Aerial photographs provide many advantages for archaeological and other scientific research. Photographs can be taken vertically, obliquely, and with a three dimensional viewpoint.[45] Additionally, the photographs can easily be interpreted by an experienced user.[46]

2. Television and Infrared Observation Satellite (TIROS)

In the 1960s, the United States launched satellite capabilities that displayed meteorological patterns.[47] The government created space imaging

37. *Id.* at 14.
38. *Id.*
39. *Id.* at 15.
40. *Id.* at 17–18 (internal citations omitted) ("Some of these photographs are stored in archives, such as in the Smithsonian Institution in Green Park Maryland, the Aerial Reconnaissance Archives in Edinburg, and the JARIC-National Image Exploitation Centre archives in Brampton, UK, and on numerous European websites . . . .").
41. *Id.* at 18.
42. *Id.*
43. *Id.*
44. *Id.*
45. Lasaponara, *supra* note 17, at 14.
46. *Id.*
47. Parcak, *supra* note 1, at 19.

systems known as Corona, Argon, and Lanyard to remotely photograph the earth from space.[48] At the time, the information was classified.[49] "After the end of the Cold War, in the 1990s, Russian and American intelligence satellite photographs were made commercially available for civilian purposes."[50] Russia only declassified its data for four years, causing many scientists to rely more heavily on the declassified information from the American imaging programs.[51] Some countries still restrict the use of aerial photography for remote sensing for military reasons.[52]

3. Landsat

In 1967, the United States Department of the Interior began a program called the Earth Resources Technology satellites (ERTs).[53] The aim of the program was to promote the use of land remote sensing data accumulation.[54] The U.S. launched the program ERTS-I and invited scientists to study data collected by the satellite.[55] Renamed Landsat in 1975, the Reagan Administration sought to commercialize and privatize the program in 1984.[56] However, due to the complexity of the technology and the prohibitive cost of value added services, the privatization plan failed, and the program was returned to the U.S. government.[57] As a result, private companies competed for contracts with the government to market and distribute the information Landsat produced.[58]

4. Global Positioning System (GPS)

The U.S. Department of Defense introduced Global Positioning System (GPS) technology in 1973.[59] GPS technology was an offshoot of research that utilized satellite navigation for military purposes.[60] In 1996, the military allowed greater civilian access to GPS technology.[61] Vehicles were

48. *Id.*
49. *Id.*
50. *Id.* at 10.
51. *Id.* at 11.
52. Lasaponara, *supra* note 17, at 11.
53. Parcak, *supra* note 10, at 22.
54. *Id.*
55. *Id.*
56. Sara M. Langston, *A Comparative Legal Analysis of US and EU Data Access Policies for Earth Remote Sensing, in* CONTEMPORARY ISSUES AND FUTURE CHALLENGES IN AIR AND SPACE LAW 271, 281 n. 31 (Sagar S.P. Singamsetty et al. eds., 2011).
57. *Id.* at 281.
58. *Id.*
59. Rengel, *supra* note 7, at 207.
60. *Id.*
61. *Id.*

equipped with GPS devices that allowed locations to be ascertained by triangulating mapping information using GPS technology. [62]

5. Google

Google is a company that began as a search engine.[63] Google's mission remains "to organize the world's information and make it universally accessible and useful."[64] Companies like Google may invade an individual's privacy by storing and tracking his or her data.[65]

Google Earth began as a company called Earth Viewer before Google acquired it in 2004. [66] Google changed the name in 2006, and developed an interactive map of the world derived from satellite images and photographs taken from the sky and ground.[67] Google Earth is a publicly available resource with high-resolution sensing capabilities.[68] Using Google Earth, people can zoom in on a target in a satellite image to see a mound, monument, or even a military installation.[69] Google Earth is a free service, but there may be restricted access to this site in some developing nations.[70] Google Earth can provide wide format maps for publications and in field use.[71]

Google Street View is a feature that allows a user to zoom in on images beyond the sight of the ordinary viewer by providing panoramic views of streets on all seven continents.[72] Google acquires these images by using a fleet of vehicles mounted with cameras and Wi-Fi antennas to capture and store data.[73] Google contracts with and uses satellites owned by both private and governmental third party operators.[74] These operators have numerous satellites that orbit the earth to collect, upload, store, transmit, and process

62. *Id.* at 207–08.

63. COMPANY — GOOGLE, https://www.google.com/about/company/ (last visited Nov. 2, 2014).

64. *Id. See also* Stephanie A. Dvos, *The Google-NSA Alliance: Developing Cybersecurity Policy at Internet speed*, 21 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 173, 190.

65. *See* Rengel, *supra* note 7, at 207. (Only two statutes prohibit companies like Facebook and Google from invading an individuals' privacy by storing and tracking their data: Children's Online Privacy Protection Act of 1998; and the Electronic Communications Privacy Act, which is totally ineffective.).

66. Parcak, *supra* note 10, at 46.

67. *Id.*

68. *Id.*

69. *Id.* at 46, 48.

70. *Id.* at 47.

71. *Id.* at 48.

72. Google Street View, *Behind the Scenes*, GOOGLE MAPS (Oct. 22, 2014), https://www.google.com/maps/about/behind-the-scenes/streetview/.

73. *Id.*

74. Marc Jonathan Blitz, *The Right to Map (and Avoid Being Mapped): Reconceiving First Amendment Protection For Information Gathering in the Age of Google Earth*, 14 COLUM. SCI & TECH. L. REV. 115, 131–32 (2012).

images on the Internet.[75] For example, the French government owns the Spot 5 program, which carries enhanced viewing instruments that can acquire repeat coverage of vast areas, yielding detailed images.[76] Google also maintains a contract for the online usage of imagery supplied by GeoEye, a company with close contractual ties to the National GeoSpatial Intelligence Agency.[77]

Congress should act now to create a comprehensive, coherent privacy statute. The spotty coverage and overall inadequacy of current American privacy laws, combined with the frightening power of private corporations (such as Google and Facebook) that compile massive databases of information about people for profit, and the sharing of those databases with governmental agencies, makes such legislative action necessary in order to properly protect privacy rights.[78]

III. THE DEVELOPMENT OF REMOTE SENSING LAWS

A. *The Outer Space Treaty*

The legal foundation for remote sensing activities is rooted in several international conventions: (1) the Outer Space Treaty, a 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies;[79] (2) the Liability Convention, a 1972 Convention on International Liability for Damage Caused by Space Objects;[80] and (3) the Registration Convention, a 1975 Convention on Registration of Objects Launched into Outer Space.[81] Two other documents germane to remote sensing activities are the UN Resolution 41/65, known as the Principles on Remote Sensing,[82] and World Meteorological Organization (WMO) Resolution 40.[83]

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75. *Id* at 152.

76. Parcak, *supra* note 10, at 65.

77. Clay Dillow, *GeoEye, DigitalGlobe Get $7 Million From Intelligence Agency to Implement Next-Gen Satellite Imaging*, Posting to *GeoEye-1*, POPULAR SCIENCE, (Aug. 10, 2010), http://www.popsci.com/technology/article/2010-08/geoeye-digitalglobe-get-7-billion-us-gov-implement-next-gen-imaging-technologies.

78. *See generally* Rengel, *supra* note 7, at 207

79. Langston, *supra* note 56, at 272.

80. *Id.*

81. *Id.*

82. Principles Relating to Remote Sensing of the Earth from Outer Space, G.A. Res. 41/65, U.N. Doc. A/RES/41/65 (Dec. 3, 1986).

83. WMO Policy and Practice for the Exchange of Meteorological and Related Data and Products Including Guidelines on Relationships in Commercial Meteorological Activities, WMO Res. 40 (Cg-XII) (1995), *available at* http://www.wmo.int/pages/about/Resolution40_en.html.

Articles I, II, and VIII of the Outer Space Treaty govern issues related to property rights.[84] Article I states that "space is the province of all mankind" and that "exploration" should be carried out for the benefit and interest of all countries, irrespective of their degree of economic or scientific development.[85] Article II limits claims of sovereignty or appropriation to the moon and other celestial bodies.[86] Article VIII mandates that individual states retain "jurisdiction and control" over objects and personnel launched into space.[87]

B. The Land Remote-Sensing Commercialization Act of 1984

The Land Remote-Sensing Commercialization Act of 1984 was the U.S. government's first attempt to commercialize the Landsat program.[88] Landsat sought to promote the national and global use of land remote sensing data.[89] The Land Remote-Sensing Commercialization Act of 1984 failed to take into account market forces such as the high cost of value added services, and the transient nature of new technology.[90] The law intended to transfer the Landsat system to the private sector in hopes of avoiding over-regulation.[91] However, the attempt to privatize Landsat failed.[92]

The United States has changed its policies since the inception of Landsat.[93] As the two main space powers, the United States and the former Soviet Union were the most active contributors to the drafting of the Principles on Remote Sensing, which intentionally avoided the regulation of military use of remote sensing data.[94] The three key components adopted in the Principles include: (a) no prior consent from the sensed state is needed, either for sensing or disseminating the data acquired by the satellites; (b) no priority for the dissemination of the sensed data; and (c) retention of sovereign rights for the individual nations.[95]

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84. Zullo, *supra* note 4, at 2418.

85. Langston, *supra* note 56, at 272.

86. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies art. 2, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205.

87. Zullo, *supra* note 4, at 2418.

88. Langston, *supra* note 56, at 281.

89. *Id. See also* Land Remote-Sensing Commercialization Act of 1984, 15 U.S.C. § 4201 et. seq. (1984) (repealed 1992).

90. Langston, *supra* note 56, at 281.

91. See Leo B. Malagar et al., International Law of Outer Space and the Protection of Intellectual Property Rights, 17 B.U. INT'L L.J. 311, n.255 (1999).

92. Langston, *supra* note 56, at 281.

93. *Id.* at 280.

94. *Id* at 274 n.10.

95. *Id.* at 280–81.

An important facet of the Principles on Remote Sensing was that private operators were granted copyright protection for data produced by their commercial systems.[96] Intellectual copyright legal protection would pass from the government to the private owners of Landsat, who would then negotiate sales contracts with the government as the need arose.[97] The 1984 Act provided that "private companies will have the exclusive right to sell all unenhanced data for the duration of the marketing contract with the government, not to exceed ten years from the date the data are sensed."[98] Therefore, at the time Congress considered the [1992 Act] proprietary rights to the unenhanced data had fallen into a limbo of ownership between the private commercialized satellite owner, the United States government, and the sensed state.[99]

C. The Land Remote Sensing Policy Act of 1992

In the Land Remote Sensing Policy Act of 1992,[100] Congress established an official data archive for Landsat and other land remote sensing data.[101] This 1992 Act commercialized private remote sensing space systems.[102] It provided for the commercial distribution of unenhanced data and value added services by the private sector.[103] The licensing requirements do very little to protect the privacy of the sensed individuals.[104] In fact, the law simply requires the system to make the unenhanced data available to the sensed state's government as soon as possible, and on reasonable terms and conditions.[105] Critically important is that this Act does not impose an obligation on the private operator to provide the sensed state's government with enhanced data or information.[106] The Act does not require the private operator to provide nondiscriminatory access to its data and information.[107]

The 1992 Act does not adequately address private operators and commercial contracts. There are a variety of U.S. federal agencies that govern the management of operations involving remote sensing, such as: NASA, National Oceanographic and Atmospheric Administration, National Geo-

96. Leo B. Malagar et al., *International Law of Outer Space and the Protection of Intellectual Property Rights*, 17 B.U. INT'L L.J. 311, 357 n.255 (1999).
97. *Id.*
98. *Id.* at 358 n.258.
99. *Id.* at 356.
100. Land Remote Sensing Policy Act of 1992.
101. Langston, *supra* note 56, at 281.
102. *Id.* at 282.
103. *Id.*
104. *See id.*
105. *Id.*
106. *Id.*
107. *See id.*

spatial Intelligence Agency, and U.S. Geological Survey.[108] Policies at these various agencies mandate that data, information, and all related products be released to the public as soon as available, including agency-generated standard products and source codes.[109] However, the term "available" is subject to interpretation. The government maintains legal ownership of some of this data, but the data is made available via the internet.[110] Additionally, the United States, in its Commercial Remote Sensing Policy, reserved the right to restrict sensitive data or control commercial remote sensing systems for national security purposes.[111]

This leaves the query germane to this paper: who owns the rights to sensed data of indigenous peoples who did not give their consent for the remote viewing?

IV. SPACE LAW AGAIN AND THE RIGHTS OF EMERGENT NATIONS

The United Nations developed five core treaties to address governmental and commercial activities in outer space through the UN Committee on Peaceful Uses of Outer Space (COPUPS).[112] As mentioned above, the international instruments that pertain specifically to remote sensing activities include: the Treaty on Principles Governing the Activities of State in the Exploration and Use of Outer Space (the Outer Space Treaty); the Convention on International Liability for Damage Caused by Space Objects (the Liability Convention); and The United Nations General Assembly Resolution adopting the Principles Relating to Remote Sensing of the Earth from Outer Space (Resolution 41/65).[113]

Resolution 41/65 provides a fairly succinct definition of remote sensing by satellite: "the sensing of the Earth's surface from space by making use of the properties of electromagnetic waves emitted, reflected or diffracted by the sensed objects for the purpose of improving natural resources manage-

108. *Id.* at 283.

109. *Id.* at 284.

110. *Id.*

111. *Id.*

112. *See* International Co-operation in the Peaceful Uses of Outer Space, G.A. Res. 1472 (XIV) A, U.N. GAOR 14th Sess., U.N. Doc. A/RES/1472(XIV) (Dec. 12, 1959). The five treaties are: Treaty on Principles Governing the Activities of States in the Exploration and use of Outer Space Including the Moon and Other Celestial bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205; Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119; Convention on International Liability for Damages Caused by Space Objects, 29 Mar. 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187; Convention on Registration of Objects Launched into Outer Space, Apr. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15; and Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 3. *See also United Nations Treaties and Principles on Space*, http://www.oosa.unvienna.org/oosa/SpaceLaw/treaties.html.

113. Langston, *supra* note 56, at 272.

ment, land use and the protection of the environment."[114] In governing the conduct of remote sensing, Principle III of Resolution 41/65 states:

> Remote sensing activities shall be conducted in accordance with international law, including the Charter of the United Nations, the Treaty on the Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial bodies ,and the relevant instruments of the International Telecommunication Union.[115]

Space law has to address many different values against a backdrop of common interests.[116] International law seems ill-fitted for the regulation of remote sensing activities that affect the individual because it can be disjointed in compliance, acceptance, and enforcement. The Outer Space Treaty of 1967, promulgated in "the Cold War era that was focused on preventing the weaponization of space and preserving its heritage . . . ."[117] However, the treaty does not address the seminal issues of privacy and appropriation of an individual's intellectual property rights.

In 1992, the Land Remote Sensing Policy Act authorized the Secretary of Commerce to issue licenses for private space-based remote sensing systems.[118] Since that time, private companies have been authorized to sell remotely sensed images of Earth acquired through remote sensing technology.[119] This commercialization of remote sensing images "has made it almost impossible to control who uses what and where."[120]

The commercialization of remotely sensed data presents more of a threat to civilian rights than the militaristic use of this data. There is no specific law that addresses the sale of remotely sensed data. Likewise, there is no specific international law or treaty that governs the secondary dissemination of remotely sensed data.[121] A privately owned company in one state (or country) can acquire remotely sensed data and disburse it without restriction.

Throughout the years, legal scholars across the country have compiled sources in an attempt to aggregate materials concerning space law and re-

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114. Principles Relating to Remote Sensing of the Earth from Outer Space, G.A. Res. 41/65 Annex at 115, U.N. GAOR, 41st Sess., Supp. No. 53, U.N. Doc. A/RES/41/65 (Dec. 3, 1986).

115. *Id.* at 116.

116. S.G. Sreejith, *Whither International Law, Thither Space Law: A Discipline in Transition*, 38 CAL. W. INT'L L. J. 331, 376 (2007–2008).

117. Joshua F. Cheslow, *The Future of Law: Four Practice Areas on the Horizon*, 283 N.J. LAW. 60, 62 (Aug. 2013).

118. Aylia Licor, Comment, *Satellite Remote Sensing: Commercialization of Remote Sensing. Is the Use of Satellite Derived Information for Military Purposes in Violation of the Peaceful Purposes Provision of the Outer Space Treaty?*, 14 ILSA J. INT'L & COMP. L. 207, 219 (2007).

119. *Id.*

120. *Id.* at 218.

121. *Id.* at 224.

mote sensing.[122] Yet the principal problem inherent in remote sensing has not been adequately addressed. Developing or emergent countries do not claim sovereign rights to satellite data concerning their resources.[123] Explicit approval of restrictions of limits on the unrestricted distribution of very high resolution images has not occurred in international law.

In space law, emergent nations argue that the confluence of international law and space law recognizes mankind as a new legal subject.[124] The nations designate outer space as the province of all mankind, and establish a new set of universal rules, a *jus humanitatis*:

> The new space law creates a legal subject, mankind as a whole, whose interests should prevail over those of single states. If space exploration and use must be carried out in the interests of all people, every state should possess the right of prior access to all satellite data concerning its territory. From the perspective of the novel legal theory of the developing countries, the State's consent is a condition precedent to the distribution of such data to third parties. This theory also mandates that all states have the right to participate in remote sensing programs and that space powers have the duty to provide technical assistance and training to this end.[125]

V. INDIGENOUS PEOPLE AND PROPERTY RIGHTS

The first encounter between indigenous South Americans and Europeans decimated the South American population, and can be recounted as genocide, oppression, and economic piracy.[126] Epidemics (both induced and unintentional) and land-robbing conquests of South America continued into the twentieth century.[127]

Political autonomy for natives continues unabated.[128] Racial ethnic groups in Brazil continue the quest for power and dominance in the struggle for social justice.[129] In commercializing the data compilations, one must consider the rights of a people to preserve their cultural identity without

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122. Joanne Irene Gabrynowicz, *Something New Under the Sun: The National Remote Sensing and Space Law Center,* AIR & SPACE LAW, Fall 2002, at 8, 10.

123. Eleonora Ambrosetti, *Remote Sensing From Outer Space: Its Significance and Problems From a Third World Perspective*, 17 N.Y.U. J. INT'L L. & POL. 1, 14–15 (1984).

124. *Id.* at 24.

125. *Id.* at 25.

126. JOHN HEMMING, RED GOLD, THE CONQUEST OF THE BRAZILIAN INDIANS 139 (Harvard Univ. Press 1978) ("During almost every year of the century from 1620 to 1720 there were official and unofficial slaving expeditions up the Amazon and its accessible tributaries. An average of perhaps one or two thousand Indians a year passed into the slave markets of Belem and Sao Luis do Maranhao: a total of 100,000–200,000 during the century. Missionaries descended many other tribes, only to see them rapidly consumed in the disease ridden mission villages.").

127. *Id.*

128. *See* Huft, *supra* note 6, at 1729.

129. *See* JONATHAN W. WARREN, RACIAL REVOLUTIONS: ANTIRACISM AND INDIAN RESURGENCE IN BRAZIL17 (Duke Univ. Press, 2001).

intrusions by others. The truth is, the indigenous groups are not on the verge of extinction, and they cannot be categorized as one monolithic group.[130] Their human rights cannot be denigrated by the use of technology to observe and collect data on their private lives.

A. Data Collection and Ownership

In discussing the property rights of indigenous people, it is easy to succumb to the western capitalistic framework of individualistic property ownership. That is, to attempt to distribute property rights to individuals as opposed to a distributive formula based on a communal or collective basis for ownership. Intellectual property rights such as trade secrets, patents, copyrights and trademarks seem ill-equipped to serve the needs of people living on their lands, claiming group ownership of traditional knowledge, and/or cultural based norms.

Multiple legal scholars have defined indigenous people to include those groups with some or all of the following characteristics:

> 1. Descendants of the original inhabitants of a territory which has been overcome by conquest;
>
> 2. Nomadic or semi-nomadic peoples, such as shifting cultivators, herders and hunters and gatherers, and practice a labor-intensive form of agriculture which produces little surplus and has low energy needs;
>
> 3. Peoples without centralized political institutions and are organized at the level of the community and make decisions on a consensus basis;
>
> 4. People who share the characteristics of a national minority, including a common language, religion, and culture; who have a relationship to a particular territory, but are subjugated by a dominant culture and society;
>
> 5. People who have a different world view, consisting of a custodial and non-materialist attitude to land and natural resources, and who want to pursue a separate development from that proffered by the dominant society; and
>
> 6. People who subjectively consider themselves to be indigenous, and are accepted by the group as such.[131]

It is an unjust enrichment to use remote sensing activities to acquire information concerning indigenous peoples, even if it is for purportedly altruistic purposes. The gathering of data to inform and expand a knowledge

130. *See* Walker & Hamilton, *supra* note 1, at 570–72.

131. *See* Solomon E. Salako, *Agro-biotechnology, Indigenous Peoples' Rights and Traditional Knowledge*, AFR. J. INT.'L. & COMP. L. (2013); *Cf.*, Mark Hanning, *An Examination of the Possibility to Secure Intellectual Property Rights for Plant Genetic Resources Developed by Indigenous Peoples of NAFTA States: Domestic Legislation Under the International Convention for Protection of New Plant Varieties*, 13 ARIZ. J. INT'L. & COMP. L. 175, 178 (1996).

base without consent, compensation, or cultural protections simply ignores international law, and borders on piracy.[132]

The use of plants, pharmaceutical knowledge, and genetic resources has been extensively discussed and debated, if not resolved, in the literature.[133] In fact, the controversy surrounding WIPO's General Assembly Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge, and Folklore continues to underscore the divide between the technology-rich industrialized countries of the north, and the biodiversity-rich developing countries of the tropics and Southern Hemisphere.[134]

B. Intellectual Property Rights

The rights of indigenous people to their territory and culture has been clearly outlined in the United Nations Declaration of the Rights of Indigenous Peoples (UNDRIP).[135] Intellectual property rights, with an emphasis on technology and the ownership of data acquired through technology, cannot legally serve the property interests of indigenous people through international or national law.[136] For the following reasons, collecting and storing data of indigenous people creates an unjust enrichment: (1) the acquisition of data through remote viewing of people is conducted without consent, and is utilized without compensation; and (2) traditional knowledge for indigenous people is not associated with western versions of commerce, except for the exploitation of resources.[137]

Patent law is unsuitable for protecting traditional knowledge data collection because it is incongruous with holistic views and beliefs that cannot be reduced to the finite regimes of intellectual property.[138] The novelty, usefulness, and non-obviousness requirements of patent law do not appear to

132. *See* Huft, *supra* note 6, at 1684–85.

133. *See id.* at 1687–88.

134. *See* Charles R. McManis, *The Interface Between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology*, 76 WASH. U. L. REV. 255 (1998); *see also* Charles R. McManis, *Intellectual Property, Genetic Resources and Traditional Knowledge Protection: Thinking Globally, Acting Locally*, 11 CARDOZO J. INT'L. COMP. L. 547, 548 (2003–2004).

135. Declaration on the Rights of Indigenous Peoples, G.A. Res. 61/295, U.N. Doc. A/RES/60/1 (Sept. 13, 2007), *available at* http://daccess-dds-ny.un.org/doc/UNCOC/GEN?NO6/52/67/PDF/NO65/207.pdf?Openelement.

136. *See* Huft, *supra* note 6, at 1689.

137. *Id.* at 1686.

138. *Id.* at 1724–25 (arguing that the rapid depletion of the world's biological diversity, and the great potential for that diversity in food medicines and other products is important, from a biological conservation standpoint as well as an economic, aesthetic and scientific vantage point. The author develops a discussion on the uncomfortable fit of indigenous knowledge and drug development because of the rigid framework of intellectual property requirements in the patent area. Huft also argues for a change in intellectual property laws to cover indigenous knowledge).

apply to the traditional knowledge ascertained by remote viewing.[139] Thus, the co-existence of remote viewers and the privacy of people in their ancestral lands cannot be neatly reconciled in patent law.[140] Additionally, trade secrets law is not applicable because it requires secrecy and commercial benefits.[141] Trademark law requires a commodification of traditional knowledge and resources, and related biological expertise.[142] Accordingly, trademark protection would not adequately protect indigenous people based on their communal use of knowledge, the lack of commodification of their lives, and the existence of data extrapolated in secret and without their consent.[143]

VI. ETHICAL OBLIGATIONS: OWNERSHIP ISSUES IN DATABASE INFORMATION

As a developing field, there are several ethical concerns regarding the use of remote sensing technology to collect data on indigenous people. Those concerns involve multiple groups of people, including:

A. Affected groups that have not been given the opportunity for consent or equitable compensation for utilization of data sharing.

B. Those who publish and distribute information concerning the affected groups must abide by standards for ethical distribution. These standards should be nationally and internationally acceptable to human study protocols.

C. Data collectors should not publish data or engage in outreach without appropriate training.

D. Regulators and the legal community, who are attempting to adopt privacy protocols prior to engaging in research and data collection.

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139. *See generally id.* at 1696–728.

140. *See id.* at 1726–28.

141. RESTATEMENT (FIRST) OF TORTS § 757 cmt. b (1939) ("A trade secret may consist of any formula, pattern, device or compilation of information which is used in one's business, and which give him an opportunity to obtain an advantage over competitors who do not know or use it."). *See also* RESTATEMENT (FIRST) OF TORTS § 758 (1939). *See also* RESTATEMENT (THIRD) OF UNFAIR COMPETITION § 39 cmts. d and f (1995) (providing that a trade secret means information, including a formula pattern, compilation, program ,device, method technique or process that derives independent economic value, actual or potential from not being generally known to, and not being readily ascertainable by proper means and is the subject of efforts that are reasonable under the circumstances to maintain its secrecy).

142. DAVID C. HILLIARD ET. AL., TRADEMARKS AND UNFAIR COMPETITION DESKBOOK § 1.01 (6th ed. 2013) ("The fundamental principles of commercial identification remain viable today, even though their origins traced back into antiquity."); Nextrend Legal, LLC, *Trademark Rights*, *available at* http://www.nextrendlegal.com/trademarks/rights/.

143. Huft, *supra* note 6, at 1689.

While these ethical concerns are compelling, scholars argue that the use of remote sensing technology may be necessary in order to preserve and protect the environment, prevent the looting of artifacts, monitor climate change, and provide answers to historical and anthropological questions.[144] Remote viewing provides the least intrusive method of creating a record of the lives of indigenous people in order to provide for their continued welfare.[145] Moreover, economic expansion cannot be controlled without measuring activities such as deforestation, mining despoliation, and agricultural land decimation.[146] Therefore, the noninvasive remote monitoring of indigenous people benefits not only the indigenous people, but also the entire human race.

A. Consent and Regulation

Third party commercial and governmental entities acquire data and store it in databases without the consent of the indigenous people.[147] Such activities continue the commercial exploitation of the very people whose data is being extracted.[148] The extraction of resources for the benefit of a dominant society is a decidedly Western concept, akin to the paternalism of missionaries who explored and settled the Americas in the 16th century.[149]

There are two approaches to regulating traditional culture within intellectual property law: preservation and innovation.[150] Preservationists want to harness intellectual property rights to safeguard culture in its authentic form,[151] whereas innovationists seek an approach that encourages tradition to evolve into new and adaptive forms of expression.[152] Sean Pager cites various scholars, such as the preservationist Tom Greaves, who "locate the threat externally in the corrupting influence of global markets: The commodification of cultural heritage, contaminates its source, distorting the meaning of tradition in ways that imperil the survival of both the heritage and its people."[153] Pager also cites innovator Kwame Appiah, who celebrates and embraces societal change, because "the failure to adapt to new

144. *See* Parcak, *supra* note 10, at 205.
145. Walker & Hamilton, *supra* note 1, at 2.
146. *Id.*
147. *Id.*
148. James W. Zion, *The Right of Native Peoples to Genetic Material as Cultural Property*, 8–9 *available at* http://www.iiirm.org/publications/Articles%20Reports%20Papers/Articles%20Dream%20Weaver%20Files/articles.htm.
149. Hemming, *supra* note 126, at 2–3, 37–38.
150. Sean A. Pager, *Folklore 2.0: Preservation Through Innovation*, 2012 UTAH L. REV. 1835 (2012).
151. *Id.*
152. *Id.*
153. *Id.* at 1835–36.

circumstances invites extinction."[154] Appiah also "celebrates contamination as enriching cultural diversity noting that producers of traditional handicrafts benefit from increased sales.[155] The innovative approach places the issue of remote sensing of indigenous people in the middle of the argument for and against strong intellectual property rights.[156] As Pager asserts, "a strong property rights model assumes that culture is a fragile flower whose integrity must be zealously defended."[157]

B. The Bigger Picture

The issue of satellite remote sensing implicates privacy concerns, international security issues, constitutional parameters, as wells as ethical issues. For example, Google and the National Security Agency (NSA)[158] have partnered, allowing for the sharing of critical information.[159] This pairing of the NSA with private companies in an information sharing, interdependent technology sector raises questions about the nations' infrastructure, transportation systems, communication networks, and the national power grid.[160] Thus, privacy rights and expectations of privacy become commingled with a governmental imperative in the use of remote sensing for viewing indigenous people.

The ability of humans to control the technology utilized for academic, scientific, casual, and observational purposes is the central issue for debate. As one scholar asserts, "the line between public and private modes of surveillance and security has blurred if not vanished."[161] "Public and private enterprises are thoroughly intertwined. The NSA program would be impossible without the assistance of telecommunications companies; the government now requires that new communications technologies be designed with back ends that facilitate government surveillance."[162] Additionally there are growing concerns with the government's incentive to leave information

154. *Id.* at 1836.
155. *Id.*
156. *Id.* at 1836–37.
157. *Id.* at 1894.
158. NATIONAL SECURITY AGENCY CENTRAL SECURITY SERVICE, *Mission*, https://www.nsa.gov/about/mission/index.shtml (last visited Oct. 23,2014); The NSA is an agency of the federal government established to provide protection for national security systems of the United States and to gather, collect and produce information about foreign intelligences. It uses the information to fight terrorism, protect military troops and provide for the national security.
159. Stephanie A. Devos, *The Google-NSA Alliance: Developing Cybersecurity Policy at Internet Speed*, 21 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 173, 177 (2010).
160. *Id.* at 218.
161. Jack M. Balkin, *The Constitution in the National Surveillance State*, 93 MINN. L. REV. 1, 7 (2008).
162. *Id.* at 7–8.

collection to private entities, because the Constitution does not restrict private entities as it does governmental entities.[163]

In addressing the privacy, security, transparency, and accountability concerns in the partnering of intelligence service information gathering of private authorities and government agencies, one author proposes the creation of a property right in personal information.[164] This protection should be coupled with a regulation on the access, transfer, use, and retention of data.[165] Requirements of technical safeguards and oversight structures such as reporting requirements, random audits, and re-visiting privacy laws on both the federal and state levels with a judicial clarification and re-structuring of privacy expectations is warranted.[166] The ownership of one's lifestyle, habits, customs, social interactions, feeding mechanisms, familial relationships, spiritual connections, health information, and locomotion is a penumbra of privacy belonging to personhood.[167]

The digitized data acquired by the satellite remote viewing of indigenous people without their consent or adherence to privacy protocols is dangerous and subject to capitalistic exploitation. The model assumes that ownership of this digitized data belongs to the corporate satellite entity for sale as property. Satellite remote viewing of indigenous societies without protection expands western colonial dominance actions of historical exploitation. Even in the face of use by academicians and scholars, the use of this data without oversight, protections, consent, and human study protocols is alarming.

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163. *Id.* at 16–17. ("Corporate business models, in turn, lead companies to amass and analyze more and more information about people in order to target new customers and reject undesirable ones. As computing power increases and storage costs decline, companies will seek to know more about their customers and sell this valuable information to other customers and the government.").

164. *See* Laura K. Donohue, *Anglo American Privacy and Surveillance*, 96 J. CRIM. L. & CRIMINOLOGY 1059, 1062 (2006) ("What makes the situation qualitatively different now is not just the lowering of the bar: digitization and the rapid advancement of technology mean that the type and volume of information currently available eclipse that of previous generations. And the issue is not confined to the United States.").

165. *Id.* at 1200.

166. *Id.* at 1063. *See also* United States v. Jones, 132 S. Ct. 945, 949 (2012) (holding that the government's installation of a global positional system tracking device to a vehicle and the use of that device for over a month to monitor the vehicle's movements, constituted a search under the Fourth Amendment. However, the Court failed to clearly articulate a precise standard for the technology in use by refusing to identify when the government conditions people to have "no expectation of privacy" will the Court modify its search test).

167. *See* William Prosser, *Privacy*, 48 CALIF. L. REV. 383, 389 (1960) (describing an analytical framework for privacy, recognized in the Restatement of Torts which still resonates today: (1) intrusion upon seclusion, (2) public disclosure of private facts, (3) false light, and (4) appropriation); *see also*, Samuel D. Warren & Louis D. Brandeis, *The Right to Privacy*, 4 HARV. L. REV. 193 (1890) (rejecting property rights and copyright as a tool to protect privacy); Katz v. United States, 389 U.S. 347, 361 (1967) (describing the test for a governmental violation of the Fourth Amendment as consisting of a "twofold requirement, first that a person have exhibited an actual (subjective) expectation of privacy, and second, that the expectation be one that society is prepared to recognize as 'reasonable.'").

VII. CONCLUSION

Remote satellite sensing is simply another form of modern technology. Indigenous people are not rats in a maze or bacteria in a Petri dish waiting for manipulation, observation, and experimental control by those who wish to advance the frontiers of science, anthropology, climate control, biodiversity, or continuation of the gene pool. They own their lives. Some European nations have decided that remote satellite viewing is too intrusive, and have begun making demands for the curtailment of such viewing.[168] I do not contend that we control the technology. Rather, I contend that we control the behavior of those utilizing the technology. Solutions must begin with the debate amongst academics, scholars, and archaeologists, with the indigenous nations at the table of discussion. Any discipline that uses aerial photography must engage in the debate on privacy and consent. Without agreeing to a fair and acceptable resolution, the West will once again be appropriating resources of the indigenous people in the name of progress. In addition, there must be a focus on the nation state where the indigenous people are located. Many of these states are constantly evolving, and the governmental institutions themselves continue to reconstruct while responding to conflicts and opportunities.[169] If one must utilize a humanistic animal analogy, one could perhaps liken un-contacted societies viewed through a private satellite company with governmental partners to canaries in the miners' cave. Methods of insufficient governance, neglected constitutional values, inadequate intellectual property concerns, and unethical behaviors may occur at the hands of the willing populace in the calculated voyeurism of an indigenous people, only to rebound and suffocate us while we sleep.

168. Lasaponara, *supra* note 17, at 292.

169. Heinz Klug, *Access to Medicines and the Transformation of the South African State: Exploring the Interactions of Legal and Policy Changes in Health, Intellectual Property, Trade, and Competition Law in the Context of South Africa's HIV/AIDS Pandemic*, 37 LAW & SOC. INQUIRY 297, 299 (2012) (arguing that the state responds to shifting opportunities and constraints, and different policies and competing political and economic factions' impact which rules are embraced, created, reshaped or ignored for and to the benefit of its people).

APPENDIX

Google Earth™

Description	A virtual 3D globe with imagery and topographic data from multiple satellite image types, aerial photographs, and the Shuttle Radar Topography Mission
Accessibility	http://earth.google.com/
Advantages	Free; available 24 hours a day; global coverage; accessible from Mac or PC; easy to use; can upload photos or points; can view 3D landscapes
Disadvantages	Non-global, high-resolution coverage, some areas have 30 m resolution coverage; limited 3D coverage of landscapes; difficult to see sites in dense canopy
Features	The user is able to view entire archaeological sites, buried walls, architecture, old river courses in desert locations, etc.; users can upload photographs of sites and features
Resolution	.6m–.30m
Cost	Free, except for certain features

NASA WorldWind

Description	An online global imagery viewing program created and run by NASA, with many similarities to Google Earth™. The biggest difference is that the full version of World Wind is entirely free. Released in 2004, individuals can view not only the Earth, but can also satellite imagery of the Moon, Mars, Venus, Jupiter, stars and the galaxy.
Accessibility	http://WorldWind.arc.nasa.gov/
Advantages	Free; available 24 hours a day; global coverage; accessible from PC, Mac, or Linux; easy to use; the user is able to upload photos, points, or GIS data; the user can view 3D landscapes
Disadvantages	Non-global, high-resolution coverage; some areas have 15–30m resolution coverage; does not display exact time or date of imagery
Features	The user is able to view entire archaeological sites, buried walls, architecture, old river courses in desert locations, etc. The user can see landscapes and vegetation change over time
Resolution	1–30 m
Cost	Free

Corona High Resolution Space Photography/KH-7/KH-9

Description	Corona high-resolution satellite photography is imagery that has become quite valuable to archaeologists, due to its high resolution, low cost, ease to obtain, and its value in recording landscapes now built over or destroyed.
Accessibility	http://www.usgs.gov
Advantages	Preserves views of many vanished landscapes; high resolution, inexpensive, and fairly straightforward use; global coverage; viewable on any image viewing program
Disadvantages	Imagery can be grainy, and users need negatives for best resolution; non-multispectral; need to georeference; sometimes memory intensive
Features	Users can view entire archaeological sites, buried walls and architecture, vanished landscapes and associated environmental features
Resolution	6–150 m
Cost	US $30 per scanned negative
Airphoto	http://www.uni-koeln.de/~al001/airphoto.html

Landsat

Description	Landsat imagery, first recorded in 1972, has had the broadest usage in archaeology of all the types of satellite imagery. This is due to its low cost, worldwide coverage, and the numerous techniques one can apply with it. Landsat imagery is most versatile in diverse landscape conditions because of varying band lengths in the electromagnetic spectrum.
Accessibility	http://www.landsat.org (click on "search for imagery" to access free data) http://glcfapp.umiacs.umd.edu:8080/esdi/index.jsp
Advantages	Global coverage from 1972–present; multispectral; users can analyze a wide range of landscape types
Disadvantages	Non-high-resolution banding on imagery from 2003–present; requires knowledge of remote sensing analysis; users need remote sensing programs for multispectral use
Features	Mutispectral data highlights vegetation, soil, and geological features associated with past remains; shows how remains can be viewed in seven bands of the EM spectrum
Resolution	15–80m
Cost	Free–US $600

SPOT

Description	SPOT, or System Pour L'Observation de Terre, launched in 1978 by the French government, is utilized in all areas of scientific research, and is especially well-suited for mapping and producing digital elevation models through stereo pairs.
Accessibility	http://www.spot.com/web/SICORP/425-sicorp-price-list.php http://www.americaview.org/
Advantages	Global coverage from 1978–present; multispectral; users can analyze wide range of landscape types
Disadvantages	Requires knowledge of remote sensing analysis; users need remote sensing programs for multispectral use
Features	Suitable for detecting vegetation changes associated with archaeological sites; panchromatic data can detect smaller architectural features
Resolution	0.8m (panchromatic), 5–20m (multispectral)
Cost	US $1200 (normal scene, 5m panchromatic, 20×20km, or 1/8th scene); US $11,750 (orthorectified 2.5m color merge, 60×60km, full scene), see pricing list on the website above; 35–85 percent discount for academic researchers through the AmericaView program.

ASTER

Description	Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), costs US $80 per scene, including free digital elevation models with scanners in the visible, near-mid and thermal IR portions of the electromagnetic spectrum. This system is particularly useful for digital elevation models, which the original data can be draped over to create 3D imagery.
Accessibility	http://glovis.usgs.gov/
Advantages	Most of the globe is covered; hyperspectral; users can analyze a wide range of landscape types
Disadvantages	Requires knowledge of remote sensing analysis; users need remote sensing programs for multispectral interpretation
Features	Hyperspectral data allows more detailed multispectral analysis
Resolution	15–90m
Cost	US $80 per scene, free for NASA partners

SRTMDescription	The SRTM (Shuttle Radar Topography Mission) provides 3D global elevation data without charge to any user.
Accessibility	http://www.jpl.nasa.gov/srtm/cbanddataproducts.html; http://edc.usgs.gov/products/elevation.html; http://seamless.usgs.gov/; http://glcf.umiacs.umd.edu/data/srtm/index.shtml; http://srtm.csi.cgiar.org/
Advantages	Free; available 24 hours a day; global coverage; accessible from Mac or PC; easy to use; can download in multiple formats
Disadvantages	Limited, high-resolution coverage; some areas have 30m resolution coverage, some imagery is more detailed than others
Features	Can view landscapes in 3D; can drape other satellite imagery on top of SRTM
Resolution	1–90m
Cost	Free

High resolution imagery: Quickbird and IKONOS

Description	Global coverage; multispectral
Accessibility	http://www.digitalglobe.com; http://www.satimagingcorp.com/; http://www.geoeye.com/CorpSite/
Advantages	
Disadvantages	High cost; users need remote sensing programs for multispectral use
Features	Both images can detect buried walls, archaeological sites, and aid in detailed mapmaking; able to locate vegetation associated with archaeological sites and features
Resolution	0.6–3.2m (Quickbird 0.6–2.4m and 0.82–3.2m IKONOS)
Cost	Quickbird costs US $10–28 per km2 with additional costs if imagery is express ordered; IKONOS costs US $7.70 per km2, or orthorectified at US $13.20 per km2

RADAR (SIR-A, SIR-B, SIR-C, X-SAR)

Description	Radar imagery is used to detect a wide range of sites and features ranging from natural to human-made, including trails, roads, and canals.
Accessibility	http://www.jpl.nasa.gov/radar/sircxsar/; http://www.dlr.de/caf/en/desktopdefault.aspx
Advantages	Near global coverage; users can see beneath sand and rainforest canopy
Disadvantages	Users need remote sensing programs for multispectral use; difficult to open
Features	Buried features (roads, rivers) can have associated archaeological remains alongside or near them
Resolution	15–45m
Cost	SIR-C US $50 (three scenes); X-SAR US $40 per scene

LIDAR

Description	LIDAR (for Light Detection And Ranging) provides high resolution detail on features beneath the ground. The detail provided by such images is unparalleled and will open up many new avenues for archaeological research, perhaps allowing for detailed mapping that, until this point, has been limited to aerial photographs, ground penetrating
Accessibility	http://www.geoeye.com/CorpSite/products/products/mjharden/lidar.aspx (US projects); http://www.lidar.co.uk/ http://www.geomatics-group.co.uk/lidar.html?lang=_e (UK/European projects)
Advantages	Users can view subtle landscape changes; high-resolution feature detection
Disadvantages	High cost; it is not possible to fly everywhere in the world
Features	Can detect field patterns, architecture and other archaeological features not visible on aerial photographs; very high resolution data can detect features not visible on other satellite images
Resolution	3cm
Cost	Depends on the project

Other airborne sensors: RADARSAT, airborne thermal radiometry

Description	RADARSAT and AIRSAR are SAR (Synthetic Aperture Radar) satellites, both with similar capabilities. RADARSAT is a commercial satellite controlled by the Canadian Space Agency, while AIRSAR belongs to NASA.
Accessibility	http://www.space.gc.ca/asc/eng/satellites/radarsat1/; http://gs.mdacorporation.com/products/sensor/radarsat/rs1_price_ca.asp
Advantages	Users can see beneath cloud cover and vegetation
Disadvantages	High cost, limited global data
Features	It is possible to identify roads, pathways, and entire sites in rainforest areas
Resolution	3m (RADARSAT-2), 8–30m (RADARSAT-1); 2.4–13.7m (SAR)
Cost	RADARSAT-1 Archived imagery US $1500; other imagery US $3600–4500; RADARSAT-2 depends on scene size, higher cost for additional processing and rush orders; ATR depends on scene size, must be worked out with NASA