Written Testimony of Professor Paul Sullivan, National Defense University, Georgetown University and the Federation of American Scientists to the House Committee on Foreign Affairs, Subcommittee on Europe, Eurasia and Emerging Threats Hearing on: Water Sharing Conflict and the Threat to International Peace, 2255 Rayburn House Office Building, November 18, 2014, 1400-1700.

Good afternoon Chairman Dana Rohrabacher, Ranking Member William Keating, and the honorable majority and minority members of this subcommittee. It is an honor and a privilege to be giving testimony on this very important issue.

Before I give any public presentation I need to give the usual caveats: these are my opinions alone and do not represent those of the National Defense University, the Department of Defense, the U.S. Government, Georgetown or any other entity I may be associated with. I come here as a citizen of this great country who has considerable knowledge and experience in issues related to energy, water, and food security as well as the regions of focus of this testimony.

I will try to keep this at the strategic level at 35,000 feet. Getting into the weeds could redirect this down into discussions that may be less than fruitful. I will focus mostly on the Blue Nile with the Great Ethiopian Renaissance Dam (GERD) in Ethiopia, with its potential effects on downstream countries, especially Egypt, and the Omo River with the Gibe dam cascade, and especially the Gibe III dam, and its effects on Lake Turkana that is partly in Ethiopia, but mostly in Kenya, and the Gibe dam cascade effects on the lower Omo Basin in Ethiopia. Both of these dam systems are well along towards completion even as tensions and other problems loom about them.

This hearing has "water sharing conflict" in its title. However, whenever water security is involved energy security and food security are not far behind. Any proper policy development regarding water needs to be seen within the energy-water-food nexus. The energy-water-food nexus is intimately connected with economic security, human security, national security of a country, and indeed international security – and potential threats to international peace.

Energy extraction, production, processing and even use often requires considerable amounts of water. As an example, the largest use of water overall in this country is in

cooling towers of electricity plants. The production of biofuels use massive amounts of water to produce. The production of gasoline and diesel use less water, but still considerable amounts of water. Large hydropower dams require the trapping of massive amounts of water, often measured in tens of kilometers cubed or trillions of gallons, to allow them to produce a certain consistent amount of electricity. Smaller hydropower dams require less distortions to a river environment and will need less water filled behind them in a reservoir. Micro-hydropower needs little or no reservoir development and can easily take care of the electricity needs of small village or towns that dot, for example, Ethiopia, especially given that Ethiopia is a mostly rural and fairly spread-out population.

Geothermal power diverts much less water per kilowatt hour than large hydropower systems. Ethiopia has significant geothermal energy resources in many parts of the country given that it has many volcanoes and is part of the Rift Valley system, a geologically hot zone. Geothermal water use also will not divert large river systems causing potentially massive tensions with downstream populations and countries.

Ethiopia has considerable solar and wind energy potential and may have not insignificant natural gas reserves, although this latter resource's potential importance is yet to be settled. Ethiopia also has the potential to use energy systems that take advantage of temperature gradients along the sides of mountains and plateaus, given its fascinating and varied topology.

Ethiopia has massive hydropower potential and is using only about 3 percent of it. Only about 20 percent of its people has access to electricity. Ethiopia is not only poor, it is energy poor. Ethiopia is looking to move its country forward via energy and other developments, but there are other ways to develop energy sources than those that mortgaging large amounts of future GDP to pay off domestic and international debt for immensely expensive hydropower project. The GERD could end up costing well over $5 billion. The numerous dam projects, including the Gibe cascade will end up costing many times the GERD. Ethiopia's GDP is about $50 billion at best and its GDP per capita may be about $500. Yes, this is a poor country pouring billions into expensive infrastructure financed with either financial or political debts to financing states, such as China.

Instead of building massive, and seemingly oversized hydropower dams at a rapid rate, and in the shadows of secrecy and surprise, it may make more sense for Ethiopia to

focus more on its other significant sources of energy and be more open about its plans with its neighbors and others. If there is one thing that makes me wonder almost as much as the potential for severe water stress in the downstream countries in the future it is the way that Ethiopia is handling the public relations and research on its massive dams, such as the Great Ethiopian Renaissance Dam.

The reports on this dam are often vague at best on the very important issues of when the reservoir will be filled and how it will be filled, amongst other issues. Environmental and social and economic impact reports are either lacking or insufficient. The sorts of reports private investors and potential funders, such as The World Bank, would require are not sufficiently there. Many international financial institutions backed off from supporting the GERD, or were never asked to support the GERD. The Ethiopian government claims that they and the sale of dam bonds, along with some aid from China, will make this happen. China does not ask for the sorts of environmental and social impact statements that The World Bank would require. An Italian company, the Chinese, and others to be named, it seems, will be developing the electricity infrastructure around the dam to connect it to the rest of the country and to, possibly, Kenya, Sudan and there is talk of connecting even to Egypt, which seems to be a bit of stretch at the moment.

The initial building of the dam started in the midst of the first revolution in Egypt in 2011, when Egypt was at its political weakest and was focused almost entirely on its internal conflicts and tensions. The timing of this dam is one of the many reasons why Egypt in particular is upset about it. Many Egyptians perceive that the Ethiopians started building this dam when they were down on the ground during one of the most difficult moments of its recent past in order to spite them, and to get around their historical rights to the Nile water. Water, food and energy shortages were some of the sparks of the rebellion. Resource security is a very big deal for Egypt and Egyptians.

Ethiopia is a poor country. It had famines in the past that shocked the world. About one million Ethiopians died in the last famine. Its political history is checkered with the sort of top-down, brute-force approach that has been further exemplified by the GERD and on the Gibe dam cascades on the Omo River. There seems to be little pushback from the communities in Ethiopia that may be harmed by these projects. There seems to be little freedom of speech on the issues related to the dam inside of the country. The upcoming elections in 2015 could be a bit more contentious than otherwise due to the vast infrastructure programs in the country -- the hydropower dams being a part of that.

Ethiopia has been growing at about a 10% rate in its GDP in recent years. Much of this growth has been from government expenditures in infrastructure. Much of the funding for this infrastructure has been from debt. One wonders where the Ethiopian economy may be headed in the next few years with this growing burden of especially domestic debt. Bond issues to Ethiopians are debt issues to Ethiopians. The bond rates are from about 1.7 percent to about 2.5 percent depending on whether they are in Euros of US Dollars and the maturity of the bond. This may seem low, but where is the income to pay these back to come from. Also, I expect the future bond needs to have higher interest rates. And the dam systems to be built will need more bonds. The GERD may also need more bond issues.

Ethiopia is betting its future on debt-financed massive hydropower projects that will likely cause even greater tensions in the future as climate change or, if you prefer, weather pattern changes, kick in. The capacity of the dams, their electricity production, and the potential for irrigation will be determined by the rains of the future. According to many those rains may be less certain then they have been in the past. Climate change and weather pattern changes could have deep impacts not only on Ethiopia, but also on its downstream neighbors of its many rivers Sudan and Egypt to the North, Kenya to the South, and Eritrea, Somaliland and Somalia to the East and southeast.

Ethiopia is sometimes called "The Water Tower of Africa", but there is just so much water to go around and it may be less in the future. Yet, the future will also likely bring population, industrial, agricultural and other growth to those along the rivers and those who rely on the groundwater and rains that develop from the river waters out of Ethiopia.

Ethiopia needs water for its population growth and it has a larger population than Egypt. Ethiopia's population is also growing faster than Egypt. Ethiopia also needs water for increased industrialization, which it plans, and more irrigation for its crops, as well as more water to produce energy. Ethiopia is in a serious drive to build hydropower dams. The most important one for the flows of the Blue Nile to Egypt is the Great Ethiopian Renaissance Dam or GERD. As I said, Ethiopia will need the energy from this dam, which is name plate of about 6000MW, but actual expected capacity of much less. Ethiopia may also need the irrigation potential that will come out of filling up the reservoir behind it.

Ethiopia claims that no irrigation will occur around the GERD and its reservoir. One of the arguments is that it is too mountainous near to it. However, Ethiopia has a history of droughts, near droughts and famine. I can see a scenario when the water from this massive dam could be redirected toward agricultural and other needs. Politically it would not be possible for Ethiopia to not use this water in times of great need, and Ethiopia has a past of unpredictable rains at times – with massive death tolls as a result.

Ethiopia as set up some very large agricultural areas with a lot of excellent land set aside for foreign companies to grow food, cotton, biofuels, etc. Ethiopia has been one of the main sources of ""land grabs" by companies and countries from Asia, the GCC, and more. Sugar plantations and other very large agricultural developments are occurring along the lower Omo River in Ethiopia.

The Omo River is the main source of water to replenish Lake Turkana in Kenya. The Ethiopian government's behavior with regard to Gibe dam cascade of five large hydropower projects, and especially the filling of the Gibe III dam, could be seen as a warning for what may happen on the Blue Nile or Abbay, as it is known in region, where the GERD project can be found. The seeming complete disregard of the poorest of the poor in the Omo River basin, and on those on shores of Lake Turkana, and those who rely on Lake Turkana for their livelihoods and existence, is an object lesson for all involved. Kenyans in this area could pay a very high price for these irrigation and energy projects in Ethiopia. Also, the electricity production from the large hydropower projects in Ethiopia in the northwest, such as the GERD and the southwest, such as Gibe, are unlikely to help the local populations much. Most of this electricity will be sent by high-voltage transmission lines to the larger cities and outside of the country it seems. Ethiopia is a mostly rural country. This may change rapidly with the rapid and intense electrification of the country. All of the positive and negative aspects of quick urbanization will result. I do not see much planning being done for balanced growth. There seems to be a headlong and headstrong drive towards “modernization at all costs”. Ethiopia may find itself in an unstable social and political environment internally unless they rebalance the way they are looking at economic development. Electrification and infrastructure development is normally good for a country and its people, but this needs to be done properly and in tune with other aspects of the economy and society.

Water is a growing problem in Egypt. The Nile has historically declining flows of water. The population of Egypt is on the rise. Egypt will need more water for that growing

population and, hopefully, its growing industry, agriculture and service sectors. Getting more people employed will likely mean more water needs.

Egypt can do a lot to increase the efficiency of its use of water in industry, agriculture and in the households, and also in energy extraction and production, but it can go just so far. Those efficiency improvements will also take time.

The Nile goes from north to south. Most of Egypt's water comes from outside of the country – about 96 to 98 percent. Most of it, about 65-75 percent of so depending on the season, comes out of the Blue Nile which originates in Ethiopia.

Sudan with a population much smaller than both Ethiopia and Egypt will also need increasing amounts of water for its growing population and other needs. Sudan expects some return from the GERD given the project is just 25 or so kilometers from its border with Ethiopia. It expects electricity, better water control and maybe even some irrigation benefits from that better water control. Again, these benefits are so far publicly unclear.

One of the tensest moments for the GERD project will be during the time that the reservoir will be filled. The slower Ethiopia fills the reservoir the slower will Ethiopia ramp up its electricity and it's so-far publicly denied irrigation potential. The faster Ethiopia fills up the reservoir the more stress will be put on Egypt and Sudan, for not only irrigation and other uses of the Nile water, but also for hydropower electricity production.

Hydropower dams in Sudan and Egypt will be producing electricity at lesser rates than otherwise as the filling happens. Egypt, of course, could use more of the water from Lake Nasser to increase the flows. However, there would depend on the existent heights of the water behind the Aswan High Dam and how much of that water can be used for hydropower. So we can see a direct connection between electricity production in Egypt and Sudan and the filling of the GERD project reservoir in Ethiopia. How the electricity production in these downstream states will be effected depends on when the filling occurs and how quickly it occurs.

On the other hand, Egypt has its Toshka Project that extracts more water from the Nile for irrigation developments in the "New Valley". This is essentially a new Nile developing westerly of the present Nile and going right into the Western Desert to develop those lands and move large groups of Egyptians from along the Nile to the

Western Desert, an otherwise fairly unpopulated place of a somewhat hostile natural environment. When Egypt started this project during the 1990s Ethiopia was quite upset about this.

The history of Egyptian-Ethiopian tensions about Nile waters go back many centuries. There were times of increased tensions when there were any discussions of putting dams in Ethiopia. The 1922 and 1959 Nile waters treaties were signed without Ethiopia even part of the negotiation, and gave all of the water of the Nile to Egypt and Sudan. In the latter one Egypt got 75 percent and Sudan got 25 percent. The rest of the countries of the Nile Basin were not even in the discussions. The Aswan High Dam in Egypt and two dams in Sudan were built based, in part, on the 1956 treaty. Most of the other lands that were part of the Nile Basin did not have their independence until after this treaty was signed.

The building of the Aswan High Dam helped prompt the Orthodox Church of Ethiopia to split from the Orthodox (Coptic) Church of Alexandria in Egypt. There were other reasons, but many think the building of the Aswan High Dam was the last straw. Inter-religious as well as international and other intergroup tensions have been a part of the Nile since there were people living on and near to it.

The tensions due to water issues were often focused on the White Nile. But all along they should have focused on the Blue Nile, where most of the Nile River, which is the confluence of the White and Blue Niles beginning at Khartoum, Sudan. In some parts of the year there are larger or smaller percentage from the Blue Nile given that the heaviest rains that fill the Blue Nile are in the June-September time periods, with the strongest rains in the July and August time periods. There are times of the year when the rains are quite low in Ethiopia and the Blue Nile flows are much less. When the rains a low or there is a drought in Ethiopia, or that water is not flowing so much out of Ethiopia, then Sudan and Egypt see the effects.

In the 1980s when the devastating droughts hit Ethiopia the effects could be felt all the way to the Mediterranean because of the overwhelming importance of the Blue Nile for the total amounts of water in the Nile proper flowing through Sudan and Egypt. Egypt was saved by the water stored in Lake Nasser. However, even with Lake Nasser as the height of the lake went down the flows out of it slowed down. Electricity production slowed way down and agricultural and other problems resulted. What happened during the Ethiopian droughts in the 1980s in Egypt is resonating today because the reservoir

behind the GERD could be as much as 65-75 cubic kilometers, which is much greater than the entire Nile flow allocated to Egypt in the 1956 treaty, about 55 cubic kilometers. The volume of Lake Nasser is just about 132 cubic kilometers, or only about twice the maximum fill volume of the GERD. One can see why the Egyptians are wary of how and over what time period this reservoir is to be filled behind the GERD. If the fill cuts too much into the downstream flows too quickly there could be extreme energy, water and food stress for the downstream countries.

Sudan also has plans to develop more hydropower and more irrigation as its population grows and its needs increase. One wonders how they will fit into this series of building international water tensions. Their leader General Al Bashir says that he is ok with the GERD project. One has to wonder what is behind that statement.

Egypt and Ethiopia, as well as Sudan need to come to some accord to figure out where all of this is going. The earlier accords that gave all of the water to the Nile to Egypt and Sudan, and yet left all the other Nile Basin countries out of the treaties can no longer work. The Nile Basin Initiative was started in 1999 to develop greater cooperative use of the Nile waters for all of the states along the Nile. Membership includes Egypt, Ethiopia, Sudan, South Sudan, The Democratic Republic of Congo, Tanzania, Uganda, Burundi, Kenya, and Rwanda. The Nile Basin Initiative seems to not be the place to resolve the Ethiopian-Egypt spat over the Blue Nile and the GERD project. It also does not seem to be the place to resolve the looming issues around the Gibe dam cascades and Lake Turkana.

The Cooperative Framework Agreement (CFA) was signed in 2010 Ethiopia, Tanzania, Uganda, Kenya, and Rwanda, under great objection from Egypt and Sudan. Burundi and joined later. South Sudan has exhibited interest in signing, but is in the midst of violent conflict and this has gotten in the way of its moving ahead on this. One of the main reasons they signed the CFA was to try to even the use of the Nile water and rights to water and the concomitant benefits from that water. The tensions on the Nile are not just from the Blue Nile, its many tributaries, and the GERD project, but also extend into the White Nile and its tributaries, which are far more important to most of the countries other than Egypt, Ethiopia and Sudan given that much of their Nile water comes from the White Nile and its tributaries and sources, as well as much better rainfall patterns than can be found in Sudan and Egypt. The international water tensions of the Nile can be separated to a great extent between those who rely on the White Nile mostly, those who rely on the Blue Nile mostly, and those who rely on both.

The tensions over water, especially in the Sudd, a large swampy area in the present-day South Sudan led to violent conflict between the northern and southern parts of the formerly unified Sudan. John Garang, the former head of the rebel group, the SPLA, wrote on the problems of water in the Sudd as part of his academic training. Many believe the second Sudanese Civil War was sparked by the attempts of the northern part of Sudan to dig the Junglei Canal through the Sudd to bring more fresh water to the north and bypassing or neglecting the southerners.

Water can lead to war in this region. As populations, economies, food and other needs grow in Ethiopia, Sudan and Egypt tensions along the Blue Nile will increase. There is just so much water to go around. The sources of most of the water for the Blue Nile are in Ethiopia, but some of the greatest future needs for the water can be found in both Egypt and Ethiopia. How this all works out could be determined as much by hydrology as it is from the relative economic, diplomatic, military and other clout of Egypt and Ethiopia.

Egypt is now quite a bit stronger than Ethiopia militarily and diplomatically, but that power has been declining in relative terms for some time. Ethiopia is not the weak state of famine-stricken people and hundreds of rebel groups that it once was. It is still a poor country, but it seems to be on the upswing with power both inside and outside of the country.

Egypt is also caught up in its own internal insurgency, a terrorism problem in the Sinai, and increasing threats out of Libya, Gaza and more. It has many more things to focus on than just the GERD, yet it seems to have periodic laser-beam focus on this issue given the importance of water security to the country. Egypt could destroy the GERD dam and many other dams to follow it, and some that were even built before it.

The questions are: (1) will they and (2) would that make any sense? If the filling of the GERD causes serious water, food and energy issues in Egypt then, frankly, it would be too late to do much of anything. Blowing up a dam with 75 cubic kilometers of water behind it would be a disaster in so many ways that it would be unthinkable. Threats from Egypt could be emotionally real, but the practical aspects of such an attack make it unlikely. Given Egypt's perilous financial and economic situation this makes war all the more unlikely, unless they can get a couple of Gulf States to fund it. However, the Gulf States have other worries to deal with, such as Syria, Iraq and their own internal stresses for some of them that are far to the top of their concerns. The Nile does not seem to be

high up in their list of concerns -- other than the concerns about the lands they are leasing and using along the Nile River Basin. Egypt has a powerful military, but its military also seems to be thinking strategically and in the longer run. They may prove to be more cautious and cunning on the issues of the Nile River, the GERD and other issues than some may imagine.

Also, Egypt has been making lots of conciliatory moves towards Ethiopia lately with trade agreements and other diplomatic accords. It seems that they may have to agree to the dam, but they may be on the hunt for other concessions on issues of importance to them to make the "accepting" of this difficult issue easier. Again, the GERD started in the midst of the Egyptian Revolution of 2011 when Egypt was too introspective and weak to put a stop to it. By the time it got to focus on the dam it really seems it was too late.

Now the negotiations for concessions and tradeoffs begin. These negotiations could involve issues related to Sudan, South Sudan, Israel, Somalia, Eritrea (Egypt backed them in their war for independence against Ethiopia), Yemen, the GCC, and, possibly, the increasing clout of Ethiopia in Africa. The negotiations will most likely include how quickly and how much the reservoir behind the dam is filled, and at what times it is filled, as well as water flows thereafter and whether any of this water will be used for irrigation or other activities that may further drain off water that could go to Egypt. Egypt is in a tough position on this. However, Egypt has been involved in East African affairs for some time, and could become problematic for Ethiopia in indirect ways if the need arises in the Egyptian perspective – or if it is needed during tougher parts of the negotiations.

There need to be better studies of the downstream and upstream effects of the GERD. More on the downstream than the upstream given the risks of conflict. Egypt needs to rethink its water use, especially in flood irrigation and the types of crops it grows. Water foot prints need to be considered by all parties involved. And some policy changes will likely need to be developed on the use and in the charging of water. There may also be some efforts put into the development of a regional power grid, where all countries will benefit from the inevitable development of hydropower in Ethiopia.

Hydropower dams are also quite dangerous in risky environments. The Geneva Accords have a special section defining the law of war with regard to how to deal with nuclear and hydropower stations. Reservoirs with trillions of gallons of water hold massive

potential for damage. This is particularly relevant if water tensions turn to water wars. As we saw fears associated with the tries at the Mosul and Haditha Dams by ISIS.

Water could lead to conflict on the Nile. The most likely conflict is between Egypt and Ethiopia, but if it does happen it would most likely be a proxy conflict not a direct one. Egypt is under water stress. Sudan is under water stress. South Sudan has massive excesses of water as do some others along the Nile Basin. There may be changes there in the future for water trade with potentially huge income streams as the tensions on the other parts of the Nile increase.

Populations, industry, agriculture and more will grow over the years within the entire Nile basin. Either better water sharing and water use policies are developed or there could be real trouble. A lot of this boils down to virtual water trade and direct water trade. It also involves understanding and using water footprints better. Above all it requires learning to get along with shared resources.

Out in the west of the US it is said that whisky is for drinking, but water is for fighting. In this part of Africa and the Middle East and North Africa water can also be for fighting. I am reminded of the scene from the movie "Lawrence of Arabia" when Sherif Ali guns down Lawrence's Bedouin guide and states that the Bedouin was nothing and the water was everything.

With climate change barreling forward and with water needs growing more needs to be done on such issues. If there are to be proper treaties then they need to be set up for the long term --- 15, 20, or even 50 years. They need flexibility to take into consideration unpredictable events and changes. These treaties also need to take into consideration that Ethiopia, Egypt, Sudan and others in the region are on their way, hopefully, to better economic and human development. And this means likely more water demand.

And what will all of the changes coming in the future in weather, the climate and human and economic development mean for the Nile, for the Omo, for Egypt, Kenya, Ethiopia and others who may be involved with the tensions building over water in East and Northeast Africa? This is still uncertain, yet the future tensions and conflicts that could erupt from these changes could make today's tensions and potential conflicts seem tame.

It is clear that the Nile Basin Initiative and the Cooperative Framework Agreement (CFA) are not working in the way they were initially intended, and not all want to be a

party to the agreements. The CFA is impotent to resolve the disputes between Egypt and Ethiopia on the GERD project and other dams that are in the plans. Egypt is not a signatory to the CFA and does not recognize it. Ethiopia does not recognize the 1959 treaty that Egypt thinks is valid in these circumstances. Egypt calls forth Article 7 of the UN Convention on Non-Navigational Uses of International Watercourses which describes "the obligation not to cause significant harm", and if harm does occur the country that caused the harm must mitigate that harm. Ethiopia is calling on the principle of equitable shares. It is a good thing that Ethiopia is not calling on the concept of complete sovereignty of internal resources. Now that would be a real mess.

International water law as it stands has no clout to alleviate the problems that will likely arise for various groups in the lower Omo River area and along and near to Lake Turkana in Kenya and Ethiopia. It seems the problems of the GIBE cascade of dams, and especially the GIBE III dam and its related irrigated plantations would fall under Article 7 of the UN Convention on Non-Navigational Uses of International Watercourse, but it also seems that Ethiopia is the more powerful party in the Omo River issues than Kenya. Maybe might really does describe "right" in water disputes. Ethiopia and Kenya are negotiating as the dam cascade system continues to be built and the irrigation schemes are leased and handed out in Ethiopia.

International law on the use of water seems very woolly indeed and is full of all sorts of holes through which many countries can walk. The Helsinki Agreements and Berlin Rules have been batted around the Nile water issues between Egypt and Ethiopia without much clarity and decisiveness. Also, how do states resolve an issues that involves the virtually unfettered flow of water to Egypt from Ethiopia since the time of the Pharos? How do countries looking forward to economic and human development in a limited water environment figure out how to share that water properly, however "properly" might be defined via negotiations, rather than war, hopefully. How could such countries figure out more efficient and effective ways of jointly using the shared and limited water resources? These and many other questions loom over the future of the Nile Basin, the Omo Basin and many other river basins, aquifers, and other sources of water in the region. Some of these basins and aquifers are connected to others in complex ways, but that is for another hearing.

International law on water has no real effective enforcement mechanism. It is based on customary laws of the past and treaties and agreements that read well, but are not enforceable. Maybe the UN Security Council could get involved. However, given the

increasing power and alliances of Ethiopia this may go nowhere. It is clearly time for the world community to develop some enforcement mechanism for laws regarding international water courses as we head into times of even greater water stress.

Why is this important for the United States? Consider the region we are discussing. Egypt, Ethiopia and Kenya are important allies and partners for the United States for various important issues such as peace and security in North Africa, the Sahel, the Horn of Africa and, indeed, in the Nile Basin. The U.S. has interests in these areas including, but not limited to: anti-terrorism efforts, the "Peace Process", freedom and security of the sea lanes of communications (SLOCS), health issues, humanitarian issues, energy security and trade security, and so much more. The United States is also focusing a lot more on Africa, a potential economic, political and military giant in the future as it finds its way towards a new future. The United States should be a positive part of that future.

Potential policy options for the U.S.:

Act as a convener, along with other stakeholder, of the parties involved with the water tensions in the region

Tie aid to the treatment of persons, groups, and tribes who will be displaced by hydropower systems.

The US and other powers could work more on developing an international system for understanding and resolving resource conflicts in the energy-water-food nexus

Considering that the Nile has competing treaties then a new set of treaty obligations could be developed that would incorporate all stake holders in the Nile Basin

The U.S. and others could develop an international coalition for the development of efficiency improving technologies for the energy-water-food nexus

The private sector in the U.S. could be encouraged to be a part of the solution to future stresses and tensions in the energy-water-food nexus in this region and others

There could be a more effective global effort to reduce the water footprints of energy and food in particular, but also of other activities and uses for water

The U.S. and others could put more effective efforts into the analysis and mitigation of land grabs in this region and others. This should also apply to water grabs, which are in effect what happens in a land grab.

As the world faces new tensions growing out of reduced water per capita supplies then more efforts technologically, diplomatically and in business could be made to help alleviate the tensions that seem so far inevitable in the future.

Pressure could be put on the parties involved in such water disputes to be a fair and as equitable as possible

The U.S. needs Ethiopia as a partner in issues related to the Horn of Africa and other parts of the region and its connected regions. However, this should not push the U.S. to take pressure off of issues that may cause far bigger problems in the future

New dam designs need to be developed for water stressed areas with greater emphasis on the effects on the downstream users of water, sediment movements, habitats, the treatment of local populations, and seismicity.

New energy diversity portfolios need to be developed for water-stressed areas and for areas that may face increasing water stress in the future

Different cropping and irrigation patterns and technologies need to be developed in the Nile Basin region, especially in the tensest areas.

The U.S. will need to work more closely with China and others who are big lenders, donors, and investors in the region to figure out better long term plans for economic and human development whilst encouraging a better development of the understand and effectiveness of the energy-water-food nexus

As the relative power relations between Ethiopia and Egypt develop the U.S. needs to keep a close eye on not only the direct relations between them, but also the indirect and proxy relations related to these tensions.

The U.S. is a major aid donor to Ethiopia. Ethiopia is an important part of our Powering Africa program. It is also an important part of our outreach to Africa. The U.S. is also a significant donor to Egypt and works with Egypt on many sensitive and important issues related to the national security and other interests of the U.S. We need to tread carefully

in the mutual development of our relations with these two important countries that often bridge Africa and the Middle East in many complex ways.

The U.S. could take a closer look at what is happening on the Omo River, how this could affect the people of the Omo River Basin, the people of Lake Turkana, and the very existence of Lake Turkana in Kenya. Kenya is also an important partner of the U.S. on many of our initiatives in the region.

The U.S. could take a close look at the water relations between Ethiopia and Somalia, South Sudan, and Eritrea. These were not part of this hearing, but could be part of a future hearing.

The U.S. could look into how it could connect the energy-water-food nexus and the nexus policies that could result from thinking in nexus ways into how it develops its relations with Egypt, Ethiopia, Sudan, other countries in the Nile River Basin and other countries in Africa. (This could be applied to our activities in other parts of the world as well, where were almost always separate out our policies on energy from those of water and those of food.)

(Sources supplied on request. Any further questions from the committee or others may be directed to Professor Sullivan at DrSullivenergywaterfood@gmail.com)