The Cornell University/Bahir Dar University (CU/BDU) Master’s of Professional Studies (MPS) program in International Agriculture and Rural Development officially began in early November 2007, when 20 students reported to BDU to begin studies in Integrated Watershed Management and Hydrology. In January 2010 another 14 students came to the Bahir Dar campus. This is the first graduate degree program where a student can earn a Cornell degree without setting foot on a Cornell campus. The core funding for the program for tuition and course-related expenses, but not research costs, is coming from several sources. Cohort 1 was funded using $150,000 from the Development Innovation Fund (DIF), which is financed by the Ethiopian Government and a World Bank loan. The Ethiopian Government and Bahir Dar University transferred these funds to Cornell University. The second cohort's core funding is provided by Higher Education for Development (HED) and USDA. Research funds have been contributed by Cornell donors and, for six students, by the International Water Management Institute-Ethiopia.

This program has helped to create a strong partnership between BDU and Cornell. Professors Tammo Steenhuis and Alice Pell have coordinated the program through the Cornell International Institute for Food, Agriculture and Development (CIIFAD); Dr. Ayalew Wondie and Seifu Tilahun have served as the Bahir Dar University coordinators with Dr. Amy Collick as Cornell University coordinator resident in Bahir Dar. Administratively, Ginny Montopoli has been the liaison to the Cornell Registrar’s office. Jim Haldeman and Bob Blake were instrumental in obtaining the initial approval from the graduate school for this unique program.

The program is based at BDU, the primary university in the Amhara region of Ethiopia. BDU's location, adjacent to Lake Tana, makes it ideal for a program in watershed management. Lake Tana contains more than 50% of the stored fresh water in Ethiopia. Excessive siltation due to inappropriate water and vegetation management in the surrounding highlands is damaging the lake. Lake Tana is the source of the Blue Nile River, whose management has been the cause of several on-going disputes among Ethiopia, Sudan and Egypt. The goal of the CU/BDU program is to train professionals who can help to institute more effective and sustainable watershed management practices.
The students

The first group of 20 students admitted to the program included 17 men and 3 women with diverse undergraduate backgrounds. The second group consisted of 14 students of which there were 11 men and 3 women. One of the second group is from Sudan. The Ethiopian students were chosen from a field of more than 300 applicants who met Cornell’s admissions criteria. The students were selected based on their undergraduate academic performance, grades on an admissions examination, teacher/employer recommendations and the students' personal statements outlining their motivation for pursuing advanced training in integrated watershed management. Almost all of the students have some practical development experience and were among the top 5% of their university classes. All of the Cornell faculty who have worked in Bahir Dar agree that cohort I is an exceptionally talented group of students. The large number of applicants was in part because of the value of a degree from a well-known university in the USA.

The classes

The students must complete 24 credits of classroom instruction and a 6-credit research or development project. The required courses include: 1) Watershed measurement, design, and planning; 2) Watershed modeling; 3) Geographic information systems & remote sensing; 4) Technical writing; 5) Management of soil and waterborne pathogens; 6) Livestock in highland farming systems; 7) Research preparation/IARDseminar; 8) Participatory methods in community watershed management; 9) Nutrient management in agroecosystems; and 10) Economic analysis of agriculture-based livelihood systems. For Cohort II, the Livestock and farming systems course was replaced by a water supply course because the HED funding emphasized water supply. After the last Cohort I course was completed on July 4, 2008, students devoted all of their time to their research/development projects. The students worked diligently on their research. Cohort I presented their research in 2009 at the IWMI workshop "Upstream-downstream impacts in the Nile" and were well received because of their field based approach and the originality of the research. Short summaries of the research projects are given in Appendix B.
The Program’s Cohort II Students

Bezawit Adana

Birara Chekol Tarekign

Dessalegn Chanie Dagnew

Dessalew Worku

Getachew Ewonetu

Getahneh Kebebe

Hasbtamu Addis

Melisew Misker

Meseret Belachew

Muhammad Elkamil

Tadesse Gasahaw

Tigist Alumu

Tigist Assafa

Zemenu Awoke
The Program’s Cohort I Students

Abrham M. Edalamaw

Aemiro G. Kassa

Anteneh Z. Abiy

Aschalew D. Tigab

Assefa D. Zegeye

Biniam B. Ashagre

Elias S. Leggesse

Emebet G. Negash

Fikru A. Mengistie

Habtam T. Kassahun

Haimanote K. Bayabil

Hussien A. Oumer

Tegegne M. Tarekegne

Tegenu A. Engda

Tenagne A. Wondie

Tsfaye H. Demeke

Tigist Y. Tebebu

Tilashwork C. Alemie

Yidnakachew E. Ayalew

Zelalem K. Tesemma
Each teaching block concentrates all of the hours of instruction of a particular course into a 3-4 week period. Six Cornell faculty members: Robert Blake, Dwight Bowman, Steven DeGloria, Chuck Nicholson, Dawit Solomon, and Tammo Steenhuis have traveled to Bahir Dar at separate times to teach an intensive two- or three-week session. Zach Easton and Daniel Fuka both from the department of Biological and Environmental Engineering helped with the second cohort teaching GIS and watershed modeling. Angela Neilan from Virginia Tech University was instrumental in making the “participatory methods in community watershed management” course a success. The Cornell program coordinator, Amy Collick, has been responsible for teaching technical writing, supervising development of project proposals, and the day-to-day activities of the program.

During a typical week, there were more than 20 faculty-student contact hours, exceeding the minimum required. The Bahir Dar students are completely immersed in one class at a time, as opposed to their Ithacan counterparts, who typically take multiple courses concurrently during a semester. To ensure that students get adequate guidance in the preparation of their research proposals, an electronic advising system was developed. Bahir Dar University provided a coordinator, transport for the students to go out to the field and two rooms furnished with computers, classroom furniture, and internet access.

The program was designed to offer students a blend of theoretical and practical studies to build their expertise in watershed management and hydrological sciences. The courses cross the disciplines of: civil and agricultural engineering; crop, soil and animal sciences; natural resource management; economics and other social sciences; and communication. The students have performed well outside of their (undergraduate) disciplinary comfort zones. The undergraduate engineers have been quick to grasp the social, economic, and biological complexities of an integrated approach to watershed management, which if not taken into account can undermine the best technical design.

Students with non-engineering backgrounds have shown an excellent grasp of hydrological engineering concepts and the ability to utilize these concepts in practical applications. For example, on a recent exam, all of the students were able to model the future pollution status of Lake Tana, assuming that the current pollutant input rates
continue. A combination of many skills is crucial to envision and foster positive steps for Lake Tana to avoid the high levels of pollution evident in Lake Victoria and the other Great Lakes of Africa.

Field trips to nearby watersheds provide important context for the program. On one trip, the students visited a Canadian-sponsored watershed project that is being studied by regional and international researchers. This site, only 40 km from Bahir Dar, is the location for some students' thesis research. Another field trip allowed the students to mingle with water resources and watershed management specialists from the International Water Management Institute and other national and international organizations. Students visited a large-scale irrigation scheme that included a large earthen dam, reservoir, and irrigated area. This visit highlighted the importance of the perceptions of members of the upstream and down-stream communities, and the utilization and maintenance of the irrigation scheme, to the managers of the watershed supplying the reservoir. The third set of field trips focused on agricultural systems and their contributions to water pollution and soil erosion. For the participatory methods course, the Cohort I students developed community surveys pertinent to their research and tested the questions during a 3-day field trip to Debre Tabor. Cohort II went to Woldya, to one of the more successful watersheds projects in Ethiopia in which Cornell was involved in the early nineteen nineties.

**Challenges faced**

The program has not been without some challenges: The broadband internet connection at Bahir Dar University is good compared to the prevailing standards in rural Ethiopia. However, when there is no electricity -- during the end of the dry season there are outages every other day -- there is no internet. Internet-based courses are not yet feasible, but the CU-BDU students can access the Cornell library system thanks to modifications made by the Mann Library staff.
There were misunderstandings about the value of the Cornell MPS degree during the initial phases of the program. Inconsistent information given by the first two instructors was part of the problem. Lack of direct contact with other Cornell graduate students who could explain misunderstandings and differences between the Ethiopian and American educational systems also played a role. These issues have been fully resolved. Students now are aware of the unique education they are receiving and are grateful to Cornell University for sponsoring the program.

Obtaining the required funding for Cohort II was more difficult and time consuming than initially anticipated since the funding has to come from outside. HED, USDA and a Cornell donor were found but the program could not start until a year after the entrance exam was given. Several students therefore could not participate. Cornell’s College of Agriculture and Life Sciences has provided a grant for their portion of tuition and fees.

The Cornell admissions panel’s merit-based selection criteria caused some misunderstandings with potential Ethiopian institutional sponsors, who had their own system of selecting criteria for further studies. Indeed, some institutions did not provide leave to the students; eleven students in Cohort I had to resign their jobs to enter the program, leaving them without income. Funds for support of students' research have been received from IWMI and three U.S. donors. Without this the program could not operate.

Students have found it challenging and rewarding to adjust to the less formal and more practical style of American higher education. Instead of teaching theoretical principles, the program teaches practical application of theoretical principles directly related to Ethiopian conditions. The relatively informal student-faculty interactions with Cornell faculty differ from those that they experienced as undergraduates. While the less formal atmosphere encourages exploration and application of new ideas, students are not always certain about what is permissible and what is not.
Although the program focuses on training students, the participation of Bahir Dar University staff in each course has steadily improved over the course of the program. The MPS program, independent in the beginning, now has an academic home in the school of Civil and Water Resources Engineering. Being within the administrative structure of the university, the program will obtain funding through the regular university process from the Ethiopian government. As of September 2011, the MPS program will be taught as a Bahir Dar University program with students receiving a MSc from Bahir Dar University.

Seventeen of the nineteen students of Cohort I have completed their MPS degree as of August 2009. (The Cohort fell from 20 to 19 when student Emebet Negash was killed in a vehicle accident.) The last two students have handed in their Thesis and will be finished soon. The second cohort has finished their course work and all are doing their research. The first Cohort II students will graduate in May 2011, the majority will graduate in August 2011 and the last will graduate in January 2012.

It was a great honor in the ceremony on July 4, 2009 to have the diplomas handed out by Dr. Skorton, President of Cornell University and Dr. Pell, Vice provost for International Relations. Of the 17 students graduated by 2010, seven are university instructors. One is working for Amhara Regional Agricultural Research Institute, one started a consulting company and three are working for NGO’s. Five students are currently pursuing their Ph.D. degree in the Netherlands, U.K. and the USA. An additional four students are actively pursuing admittance to a Ph.D. program.
The program’s five coordinators commend the students, faculty and university administrators in both countries for their admirable and unflagging efforts to get this program going. We have all learned a tremendous amount in the process. The next group of students is gaining from this experience.

**Research aspects**

In order to earn a Master’s degree, students must earn 24 credit hours of course credit and do a thesis (6 credits). The students’ research findings have been exciting and actually contributed new knowledge in our understanding of watersheds’ hydrologic behavior. For example three students in Group 1 -- Tigist, Aneteneh and Assafa -- all did their research in the Debra Mawe watershed 40 km south of Bahir Dar. Tigist observed gully formation and proved that the greatest erosion rates occurred by gully erosion when the water table is above the bottom of the gully. Her findings explain the many gullies that form in the lowest part of the landscape where the slope is the flattest and the water velocity the slowest. Anteneh who cooperated with Tigist identified geologic features that explain why in certain places the water table was elevated. Finally Assawa measured upland erosion in the same watershed and found that erosion rates were greater at the bottom of the hill with the flattest slopes than at the top of the hill with the steepest slopes. By measuring the moisture content at the different slope positions he could prove that more overland flow was generated downhill than upslope, causing more erosion downslope than upslope. A final interesting fact was that upslope erosion caused on the average a 1mm per year soil depth loss while gully formation was equivalent to an almost 5 cm soil loss over the same watershed.

Another group of students of Cohort I -- Teganu, Haimanote, Elias and Biniam -- looked at the relationship between water table depth and runoff processes. They found high infiltration rates throughout the watersheds, and saturated bottom parts where all the infiltrated water from the hillsides accumulated. Most overland flow was generated in the bottom part of the landscape with shallowest slopes, which may seem counterintuitive. They also showed that subsurface flow plays an important role in the hydrology of the watershed.

Achalew, Tegegne and Yidnekachew did surveys on water supply and irrigation, and confirmed that systems in which people had a say in the design from initiation of the project were most successful. Tesfay, who compared management systems in three watersheds, similarly found that management succeeded when the farmers could make choices in what measures should be implemented. This is a similar finding to the New York City watershed in which farmers are also in the driver’s seat on how best to reduce phosphorus and pathogen inputs to the reservoirs. In the Koga watershed, payment for environmental services was investigated by Habtamu, and Fikru investigated the factors
that affect adoption of soil and water conservation practices. Tilashwork determined that the two most problematic effects of eucalyptus trees on the surrounding crops are the minimal amount of light that can penetrate the canopy and the soil becoming water repellent. Although not investigated, these trees are also more effective in removing water from the subsoil during the dry periods than other tree species. Finally Zelalem studied if the flow in the Nile is decreasing over time.

Cohort II started their research in fall 2010. The topics of their research are given in Appendix C. Four students -- Dessalign, Habtamu, Meseret, and Zemenu -- are studying how to improve rural community water supply systems. This is important since 60-80% of installed systems have been failing within three years after establishment. Bezawit is studying erosion in one of the head watersheds of Lake Tana. The research of Birara, an employee of the bureau of agriculture, is especially interesting and his personal story (Appendix D) is featured in a promotional brochure being prepared by sponsor HED.

Ethiopia is becoming more developed and with this development waste generation increases. Dessalew is researching how best to maintain the current practice of recycling. In addition he is looking at how a current landfill pollutes the neighbors’ wells. He found high E. Coli counts in most sampling points and extreme high zinc content in two of the sampling points likely from batteries that are being dumped in the landfill. Getaneh and Tigist Alemu are looking at the impact of irrigation practices on income of male and female household members. Melesew and Tigist Assefa are studying existing traditional irrigation systems and how these practices can be employed in newly developed schemes. Tadesse is researching how sustainable irrigation systems are in the drier parts of Ethiopia. Finally Muhammad will be looking at the effectiveness of soil and water conservation practices based on long term data in three watersheds where such conservation practices have been installed.

Finally, this group of Ethiopian students with their instructors has been amazingly productive scientifically. A total of 11 refereed manuscripts in international journals, three book chapters and five Ethiopian journal articles have been published so far and we are sure that more will follow.
Appendix A:
MPS Program in Integrated Watershed Management and Hydrology
Cornell and Bahir Dar Universities

Course Schedule 2007-2008, Cohort 1

List of times and courses for the Masters Program in Integrated Watershed Management and Hydrology

<table>
<thead>
<tr>
<th>Dates</th>
<th>Course Number</th>
<th>Course Title</th>
<th>Instructors</th>
<th>No. of credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov 1-21, 2007</td>
<td>BEE 694</td>
<td>Watershed design, measurement &amp; planning Interim period</td>
<td>Tammo Steenhuis, Amy Collick</td>
<td>3</td>
</tr>
<tr>
<td>Nov 21-28</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov 29-Dec 28</td>
<td>BEE 694</td>
<td>Watershed modeling</td>
<td>Tammo Steenhuis, Amy Collick</td>
<td>4</td>
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<tr>
<td>Dec 28-Jan 6, 2008</td>
<td>IARD 694</td>
<td>Technical writing seminar/computer skills Christmas break (Ethiopian)</td>
<td>Tammo Steenhuis, Amy Collick</td>
<td>1</td>
</tr>
<tr>
<td>Jan 7-Feb 2</td>
<td></td>
<td></td>
<td>Amy Collick</td>
<td></td>
</tr>
<tr>
<td>Feb 2-Feb 9</td>
<td></td>
<td>Technical writing</td>
<td>Amy Collick</td>
<td>1</td>
</tr>
<tr>
<td>Feb 18-Mar 6</td>
<td>CSS 471</td>
<td>Geographic information systems &amp; remote sensing</td>
<td>Steve de Gloria</td>
<td>3</td>
</tr>
<tr>
<td>Mar 10-21</td>
<td>VETMI 783</td>
<td>Management of soil and waterborne pathogens</td>
<td>Dwight Bowman</td>
<td>2</td>
</tr>
<tr>
<td>Mar 24-Apr 18</td>
<td>ANSC 694</td>
<td>Livestock in highland farming systems</td>
<td>Bob Blake</td>
<td>3</td>
</tr>
<tr>
<td>Apr 20-25</td>
<td></td>
<td>Research preparation/IARD seminar</td>
<td>Tammo Steenhuis, Amy Collick</td>
<td>1</td>
</tr>
<tr>
<td>Apr 28-May 16</td>
<td>BEE 697</td>
<td>Participatory methods for community watershed and water supply management</td>
<td>Tammo Steenhuis, Angela Neilan, Amy Collick</td>
<td>3</td>
</tr>
<tr>
<td>May 18-Jun 6</td>
<td>CSS 477</td>
<td>Nutrient cycling in natural and managed ecosystems</td>
<td>Dawit Solomon, Johannes Lehmann</td>
<td>2</td>
</tr>
<tr>
<td>(two weeks)</td>
<td>AEM 694</td>
<td>Economic analysis of agriculture-based livelihood systems</td>
<td>Chuck Nicholson</td>
<td>2</td>
</tr>
<tr>
<td>Jun 9-20</td>
<td>IARD 699</td>
<td>Seminar in international agriculture and rural development</td>
<td>Amy Collick, All</td>
<td>1</td>
</tr>
<tr>
<td>Throughout</td>
<td>IARD 599</td>
<td>IARD MPS thesis</td>
<td>IARD faculty</td>
<td>6</td>
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<tr>
<td>July- Nov 2009</td>
<td></td>
<td></td>
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</table>
## MPS Program in Integrated Watershed Management and Water Supply

**Cornell and Bahir Dar Universities**

### Course Schedule 2010, cohort II

List of times and courses for the Master’s Program in Integrated Watershed Management and Water Supply

<table>
<thead>
<tr>
<th>Dates</th>
<th>Course Number</th>
<th>Course Title</th>
<th>Instructors</th>
<th>No. of credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 4-Mar 13, 2010</td>
<td>BEE 694</td>
<td>Hydrology, erosion and watershed management</td>
<td>Steenhuis, Seifu Tilahun</td>
<td>2</td>
</tr>
<tr>
<td>Mar 14-Mar 26</td>
<td>VETMI 783</td>
<td>Management of soil and waterborne pathogens</td>
<td>Bowman, Liotta</td>
<td>2</td>
</tr>
<tr>
<td>Mar 29-Apr 16</td>
<td>BEE 695</td>
<td>Geographic information systems &amp; remote sensing</td>
<td>Fuka, Abejou, Steenhuis</td>
<td>3</td>
</tr>
<tr>
<td>Apr 19-Apr 30</td>
<td>BEE 697</td>
<td>Rural water supply</td>
<td>Steenhuis, Collick</td>
<td>2</td>
</tr>
<tr>
<td>May 2-May 21</td>
<td>IARD 699</td>
<td>Technical writing and preparation of research proposals</td>
<td>Collick and Seifu Tilahun</td>
<td>1</td>
</tr>
<tr>
<td>May 24-Jun 13</td>
<td></td>
<td>Research period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jun 15-July 9</td>
<td>AEM 694</td>
<td>Economic analysis of agriculture-based livelihood systems</td>
<td>Nicholson</td>
<td>3</td>
</tr>
<tr>
<td>Jul 12-Aug 6</td>
<td></td>
<td>Research period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aug 9-Aug 27</td>
<td>CSS 672</td>
<td>Nutrient cycling in natural and managed ecosystems</td>
<td>Solomon and Lehman</td>
<td>3</td>
</tr>
<tr>
<td>Sep 6-Sep 24</td>
<td>DSOC 694</td>
<td>Participatory methods for community watershed and water supply management</td>
<td>Neilan and Makki</td>
<td>3</td>
</tr>
<tr>
<td>Sep 27-Oct 22</td>
<td>BEE 694</td>
<td>Watershed modeling</td>
<td>Easton, Fuka Steenhuis</td>
<td>4</td>
</tr>
<tr>
<td>Throughout</td>
<td>IARD 699</td>
<td>International agriculture and rural development seminar</td>
<td>Steenhuis, Collick, Seifu</td>
<td>1</td>
</tr>
<tr>
<td>Oct to Dec 2011</td>
<td>IARD 599</td>
<td>IARD MPS thesis</td>
<td>IARD faculty</td>
<td>6</td>
</tr>
</tbody>
</table>

*) Student research period will begin on May 24 pending the approval of a student’s research proposal. Special topics in the courses after May 24 will relate in part to research location and/or topic by student. The research period is finished after approval of the thesis by the student’s special committee.
Course Descriptions

AEM 694: Economic Analysis of Agriculture-based Livelihood Systems
2 credits. C. Nicholson

Introduces the application of economic theory and analytical methods for the evaluation of coupled human-natural systems with an emphasis on agriculture-based livelihood systems. Discusses principles of partial budgeting analysis, static and dynamic optimization and system dynamics modeling. Exercises illustrate the application of these methods to assess technological and policy interventions at the enterprise, farm and market level.

AN SC 694: Livestock in highland farming systems
3 credits. B. Blake

Focuses on the systematic analysis of constraints and opportunities in the animal component of integrated crop-tree-livestock systems. Emphasis is on strategic use of animal and plant resources, animal performance with restricted inputs, decision-making, and alternative production systems for the Ethiopia highlands.

BEE 694: Watershed design, measurement and planning (Cohort 1)
3 credits. T. Steenhuis & A. Collick

Introduces students to the physical principles governing water and sediment movement. Emphasis is on practical application and designs for improved water and erosion control in degraded highland watersheds. Assignments involve engineering problems relevant in the Ethiopian context, with hands-on experience as possible. Also covers design of water harvesting systems with limited data.

BEE 694: Watershed modeling
4 credits. T. Steenhuis & A. Collick

Introduces students to concepts and tools for modeling watersheds using a system dynamics framework. Emphasis is on the integrating existing sources of information
(maps, surveys, etc) and local knowledge about Amhara watersheds with research findings from the project.

**BEE 697/DSOC 694: Participatory Methods for Community Watershed and Water Supply Management**

3 credits. A. Neilan, Makki, & A. Collick

In-depth practical, field-based course designed to provide experience with participatory methods to help communities manage their own watersheds within an overall regulatory framework. Special emphasis is given to action research approaches involving all relevant stakeholders.

**CSS 420/BEE 695: Geographic information systems & remote sensing**

3 credits. S. DeGloria, D Fuka and T. Steenhuis

Introduces students to the principles and applications of geographic information systems and remote sensing for the characterization and assessment of agricultural and environmental resources. Covers methods and equipment for accessing, updating, and mapping spatial data and information. Considers needs assessment, coordinate systems, map accuracy assessment, database design and maintenance, data transformation and analysis, and project design.

**CSS 672: Nutrient cycling in natural and managed ecosystems**

3 credits. J. Lehmann & D. Solomon

Covers nutrient cycling in soil and the interface between the soil and the biosphere, atmosphere, and hydrosphere. Examines the biogeochemistry of nutrient elements in natural ecosystems, disturbed or degraded ecosystems, and agricultural systems, including pollution in watersheds.

**IARD 599: International Agriculture and Rural Development Project in Integrated Watershed Management**

6 credits. IARD faculty
Problem-solving thesis entailing fieldwork. The aim of the thesis is to give students supervised experience in dealing intellectually and analytically with a professional problem related to integrated watershed management.

**IARD 699: International Agriculture and Rural Development Seminar**

2 credits. A. Collick, R.Blake and T.S. Steenhuis

Serves as a forum for discussion of key issues in international agriculture and rural development, with particular attention to interdisciplinary complexities of integrated watershed management.

**VETMI 783: Management of soil and waterborne pathogens**

2 credits. D. Bowman

Involves an in-depth look at pathogens in animal and human waste and their survival in soil and water. Emphasis is on methods of pathogen control, with special attention directed to water sanitation and supply in the Ethiopian context.

**BEE 494: Hydrology, Erosion and Watershed Management (Cohort II)**

3 credits. T Steenhuis ACollick and Seifu Tilahun

Introduces students to the physical principles governing water and sediment movement. Emphasis is on practical application and designs for improved water and erosion control in degraded highland watersheds. Assignments involve engineering problems relevant in the Ethiopian context, with hands-on experience as possible. Also covers design of water harvesting systems with limited data.

**BEE 694: Watershed Modeling (Cohort II)**

4 credits. Zach Easton and Tammo Steenhuis

Introduction of concepts and tools for modeling watersheds using a system dynamics framework. Emphasis is on the integrating existing sources of information (maps, surveys, etc) and local knowledge about Amhara watersheds with research findings from the project. Both simple and more complex models will be discussed.
BEE 697: RURAL WATER SUPPLY (Cohort II)

2 credits. Tammo Steenhuis, Amy Collick

Focuses on the systematic analysis of water supply systems and its management. Realistic assessment of both traditional household water supply systems and improved systems. Field trips to view the systems of water supply. Discussions with experts and stakeholders on best methods for water supply.
Appendix B:

RESEARCH PUBLICATIONS

Refereed


Bayabil, Haimanote K, Seifu A. Tilahun, Amy S. Collick, Birru Yitaferu, and Tammo S. Steenhuis. 2010 Are runoff processes ecologically or topographically driven in the (sub) humid Ethiopian highlands? The case of the Maybar watershed. Ecohydrology 4: 457-466


Book Chapter


Other Publications


Tebebu, Tigist Y., Anteneh Z. Abiy, Assefa Zegeye, Helen E. Dahlke, Eric D. White, Amy S. Collick, Selemyihun Kidnau, Farzad Dadgari and Tammo S. Steenhuis. 2010 Assessment of hydrological controls on gully formation and upland erosion near Lake Tana, Northern Highlands of Ethiopia. 9th Federal Interagency Sedimentation and 4th Hydrologic Modeling Conferences being held June 27th - July 1st, 2010 in Las Vegas, Nevada

Appendix C

Students and Research (Cohort II)

Bezawit Andane: Assessment of temporal hydrological variation due to watershed management option by using validated distributed swat model in Gummera watershed, Ethiopia

Birara Chekol Tarekegn Assessment of gully formation and development in the high lands of Blue Nile Basin, Ethiopia.

Dessalegn Chanie Dagnew Factors determining residential water demand in north western Ethiopia: The case of Merawi Town

Dessalew Worku Environmental and health impact of solid waste: assessment on solid waste disposal site of Bahir Dar City, Ethiopia

Getachew Ewonetu Assessment of Ground Water use Constraints to Irrigation Crop Productions at Fogera Plain, North Western Ethiopia.

Getaneh Kebede Ayele The impact of selected small scale irrigation schemes on poverty reduction in Ethiopia Highland, Tana Basin, Ethiopia

Habtamu Addis Challenges in rehabilitation of non-functional rural water supply: Mecha, Amhara Region, Ethiopia

Melisew Misker Organization and management of traditional irrigation schemes In Eastern Amhara, Ethiopia

Meseret Belachew Assessment of water supply sources and determinants of household water consumption in Simada woreda, Ethiopia

Muhammad Elkamel Effectiveness of Soil and Water Conservation Practices in the Blue Nile Basin

Tadesse Geshaw Effect of irrigation on groundwater levels in the Lake Ziway, Rift Valley Ethiopia

Tigist Alemu Assessing the Impact of Irrigation in Male & Female Households Productivity and Income

Tigist Assefa Assessment of the factors affecting the structural failures of irrigation and water harvesting schemes in Jari integrated watershed development project

Zemenu Awoke An Assessment of Challenges of Sustainable Rural Water Supply: Quarit Woreda, Amhara Region
# Summary of Student Research (Cohort I)

Supported through CP19 Upstream/downstream project: BDU, ARARI, IWMI, and Cornell

<table>
<thead>
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<td>Success and Failures in Watershed Management projects: A post implementation evaluation</td>
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<td>Mike Walter</td>
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<td>Northern Highlands of Ethiopia and Factors Affecting Adoption Decision of Soil and Water Conservation Measures: Case of Andit-Tid Watershed</td>
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<td><a href="mailto:thd29@cornell.edu">thd29@cornell.edu</a></td>
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Appendix D

Draft Promotional Brochure for Higher Education for Development

Advancement through Education in Ethiopia

Program in Integrated Watershed Management and Water Supply
Cornell University/Bahir Dar University, Bahir Dar, Ethiopia

Birara is a graduate student in the Cornell University Master’s program in Integrated Watershed Management and Water Supply conducted at Bahir Dar University, Ethiopia in which he studies innovative ways of making watershed protection improvements more successful. He has a long term plan to educate himself in order to qualify for higher positions that have more pay so his two children can have a good university education once they graduate from high school.

As an extension agent with a high school diploma and with a family of four, he decided to further his knowledge. He decided first to attend a two year college, graduated and went back to work. He then went on to Mekele University to obtain a BS degree in Land Resource Management and Environmental Protection. Seeing the announcement for the Cornell University Master’s program, he applied and was admitted. The interdisciplinary Cornell Masters program is supported by HED and hosted by the School of Civil And Water Resources Engineering at the University of Bahir Dar in Bahir Dar on the shores of Lake Tana in Ethiopia. The Master’s program offers the student a program that is taught by American teachers in blocks on the Bahir Dar University campus. It offers a Cornell degree without ever setting foot on the Cornell campus. This has many benefits including an ability to educate 10 students in Ethiopia for the cost of sending one Ethiopian Master’s student to the US.

For his research, Birara is studying gully erosion in the same watershed where as an extension agent he was in charge of implementing soil and water conservation structures. He noted that after the structures were put in place, the gully erosion became worse. By installing weirs to measure the river flow and water table measuring devices, in treated and non-treated areas, he will be able to find the relationship between gully formation and the earlier soil and water conservation practices. This will help farmers and development professionals to fine tune the recommendations for conserving water and soil.

Birara is determined to further his education and obtain a PhD degree. The Cornell degree and the support provided to this program by HED will give him an excellent chance to obtain a scholarship and fulfill his wish.