Annual Report

Patel College of Global Sustainability

2017-2018

2017-2018 Academic Year Highlights

- Welcomed a permanent Dean
- Admitted student numbers increased.
- Worked with the council of deans to review and modify academic organizational model
- Increased Enrollment
- Funded three research projects through the inaugural PCGS Interdisciplinary Research Grant Program
- Became a designee of the UNWTO International Network of Sustainable Tourism Observatories
- Won a multi-year completive grant from the US Department of Agriculture on jet biofuel development
- Faculty member recipient of a Carnegie African Diaspora Fellowship
- The number of graduates securing employment within six months of graduation increased.
- Developed new partnerships
- Funded a Coverdell Fellowship
- Funded a Latin American and Caribbean scholarship

Dean's Message

It is with great enthusiasm I present the 2017-2018 Annual Report for the Patel College of Global Sustainability (PCGS). The 2017-2018 Academic Year was an important period for PCGS's effort to become a truly interdisciplinary degree-granting College of the University of South Florida. PCGS made great strides in meeting and exceeding the strategic goals set for the College. We saw remarkable increase in competitive external funding for research and in student enrollment numbers. We enhanced student success, raised admission standards, and revised and updated graduate curriculum to reflect the rapid changes taking place in the field of global sustainability education and research in the State of Florida, the United States, and elsewhere in the world.

The academic mission of PCGS is achieving sustainable development, both locally and globally, by fostering social, economic and environmental sustainability; we accomplish this through teaching, research, student mentoring and community outreach, as well as by generating practical knowledge and developing innovative technologies, skills and policies. This mission is well aligned with the strategic priorities of the University of South Florida as a pre-eminent global research university. The College is engaged in education, research, and service activities that create solutions for sustainable development in a rapidly-changing world, based upon USF's broad, interdisciplinary expertise in renewable energy, water, climate science, public health, energy, transportation, global security, and social equity, among others. This interdisciplinary approach prepares our students well for career options and professional opportunities with industries, governmental agencies (at city, county, state and federal levels), international organizations and NGOs that are seeking solutions to sustainability challenges.

Drawing upon various definitions of "sustainability" we seek to ensure that these efforts both endure and dramatically expand at USF; that they encourage the natural interconnections among those groups on campus addressing ecology, economics, politics and culture; that they recognize the essential contributions of scholars and professionals in engineering, business, architecture and urban planning, transportation, health, global studies and the natural and social sciences; and that they serve to create and maintain the conditions under which humans and nature can co-exist in productive harmony, fulfilling the social and economic requirements of present and future generations.

The College of Global Sustainability has been successful in enhancing its role as the hub for sustainability-related research and teaching across the USF campus. The College partnered with a number of universities and companies to form a public-private consortium, which won a competitive $15M five-year award from the US Department of Agriculture to develop a sustainable bio-economy in the United States based on renewable jet fuel, animal feed, and consumer products from non-edible plants. The College hosted three well-attended luncheons in the fall for faculty members across the USF campus to get to know their work

related to sustainability and to encourage them to work with the College as affiliate faculty to engage in joint research and teaching. PCGS collaborates with five USF Colleges – College of Arts & Sciences, College of Engineering, College of Business, College of Marine Sciences, and the College of Public Health. In my capacity as Dean, I actively seek out input and advise on academic matters from the College Advisory Board made up of the Deans of these USF Colleges. This Advisory Board meets twice a year, most recently met in January 2018. The College went through its first seven-year academic review by an external evaluator designated by the Provost. The external evaluator from the Center for Global Sustainability at the School of Public Policy of the University of Maryland visited the College in February 2018; we are waiting for the Report from the evaluator for review and action.

The College has received approval from the Graduate Council to launch a new MA concentration in Global Sustainability Policy starting fall 2018, which is supported by the Schools of Public Affairs and Geosciences in the College of Arts & Sciences. The College is expected to add new faculty members during the 2018-2019 Academic Year.

Govindan Parayil, Ph.D.
Dean

Establishment & Brief History

The Patel College of Global Sustainability was officially established in 2014 as a degree-granting college of the University of South Florida on the basis of the Patel Center of Global Sustainability, which was founded in 2009. The college is engaged in education, research, and service activities that create solutions for sustainable development in a rapidly-changing world based upon USF's broad, interdisciplinary expertise in the areas of renewable energy, water, climate change, public health, transportation, global security, and social equity.

The Patel College of Global Sustainability comprises the M.A. Program in Global Sustainability, Patel Center for Global Solutions, and the Graduate Certificate Program in Sustainability. It is an inclusive and holistic college based on interdisciplinary research, teaching and service and has partnered with several USF Colleges to carry out these activities.

One of the unique features of the college enshrined in its mission is to work as the hub for sustainability-related research and teaching across the USF campus; thus far, the College has collaborated with five other USF Colleges – College of Arts & Sciences (especially the School of Geosciences and the School of Public Affairs), College of Engineering, College of Business, College of Marine Sciences, and the College of Public Health.

Two significant leadership changes since the establishment of the college was the appointment of Richard Berman as the Interim Dean in August 2015 (under his leadership the college developed and launched five new Master's degree concentrations and graduate certificate programs), and the appointment in July 2017 of Govindan Parayil as the permanent Dean.

Mission, Vision, Values & Goals

Mission

The mission of PCGS is achieving sustainable development, both locally and globally, by fostering social, economic and environmental sustainability; we accomplish this through teaching, research, mentoring students and community outreach, as well as by generating practical knowledge and developing innovative technologies, skills and policies.

Vision

Drawing upon various definitions of "sustainability" we seek to ensure that these efforts both endure and dramatically expand at USF; that they encourage the natural interconnections among those groups on campus addressing ecology, economics, politics and culture; that they recognize the essential contributions of scholars and professionals in engineering, business, architecture and urban planning, transportation, health, global studies and the natural and social sciences; and that they serve to create and maintain the conditions under which humans and nature can exist in productive harmony, fulfilling the social and economic requirements of present and future generations.

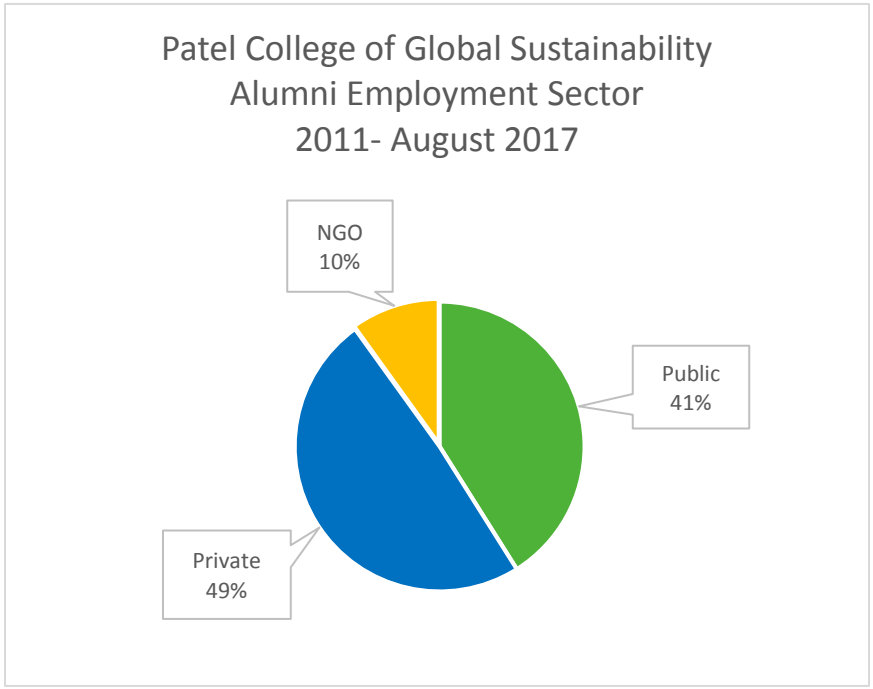
Student Development

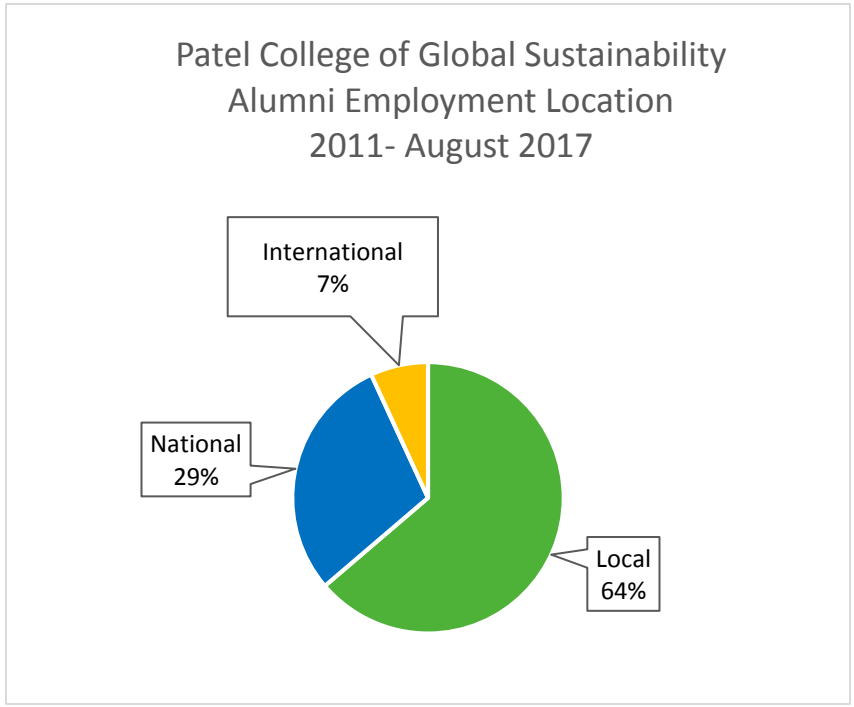
The Patel College of Global Sustainability maintains a Student Development program that offers general advising to all students and alumni, including résumé building assistance, résumé reviews, career choice advising, and networking opportunities. Students are also provided with a list of suggested certifications, relevant professional organizations, and specific companies that are hiring graduates in the field of sustainability, as well as information about the University's Career Services—all of which are accessible at all times via the college's website. In addition to this general advising, the Student Development program offers several workshops each semester that focus on building students' professional skills and making them more valuable in the job market. The program also hosts a Sustainability Speaker Series each semester, bringing sustainability professionals into the college to speak with students about working in the field. These speakers have come from the Florida Fish and Wildlife Conservation, NOAA, local Environmental Protection Commissions, and large Corporations such as MOSAIC, Duke Energy, and Tampa Electric, among others. The Student Development program also organizes trainings at the college for relevant sustainability certifications such as LEED GA and GIS. The PCGS Internship Coordinator assists students finding internship opportunities and placements to increase their professional development to give them a competitive edge in acquiring positions in the field.

Outstanding Recent Alumni Hires

- Hydrologist, Southwest Florida Water Management District
- Energy Specialist, Cenergistic
- Global Environmental Health and Safety Expert, Jabil
- Senior Project Specialist, Stantec
- Environmental Health & Safety (EHS) Manager, Formulated Solutions
- Sustainability Officer, Houston Community College
- Environmental Project Manager, HDR
- Recycling and Sustainability Manager, Leon County
- Recycling Manager, Goodwill
- Sustainability Consultant, ERM
- Environmental Consultant, Handex Consulting & Remediation, LLC
- Energy Analyst, Arrowpoint Corporation
- Regional Coordinator, National Oceanic and Atmospheric Administration (NOAA)

Alumni Employment





Sustainability Speaker Series

The Student Development Office at the Patel College organizes a Sustainability Speaker Series each semester, bringing sustainability professionals into the college to speak with students about working in the field. The speaker series was established to create increased knowledge and awareness among our students about innovative sustainability practices in private and public organizations. Previous speakers have included researchers from the Florida Fish and Wildlife Conservation, the National Oceanic and Atmospheric Administration (NOAA), local Environmental Protection Commissions, and more. Our fall 2017/Spring 2018 Speakers included:

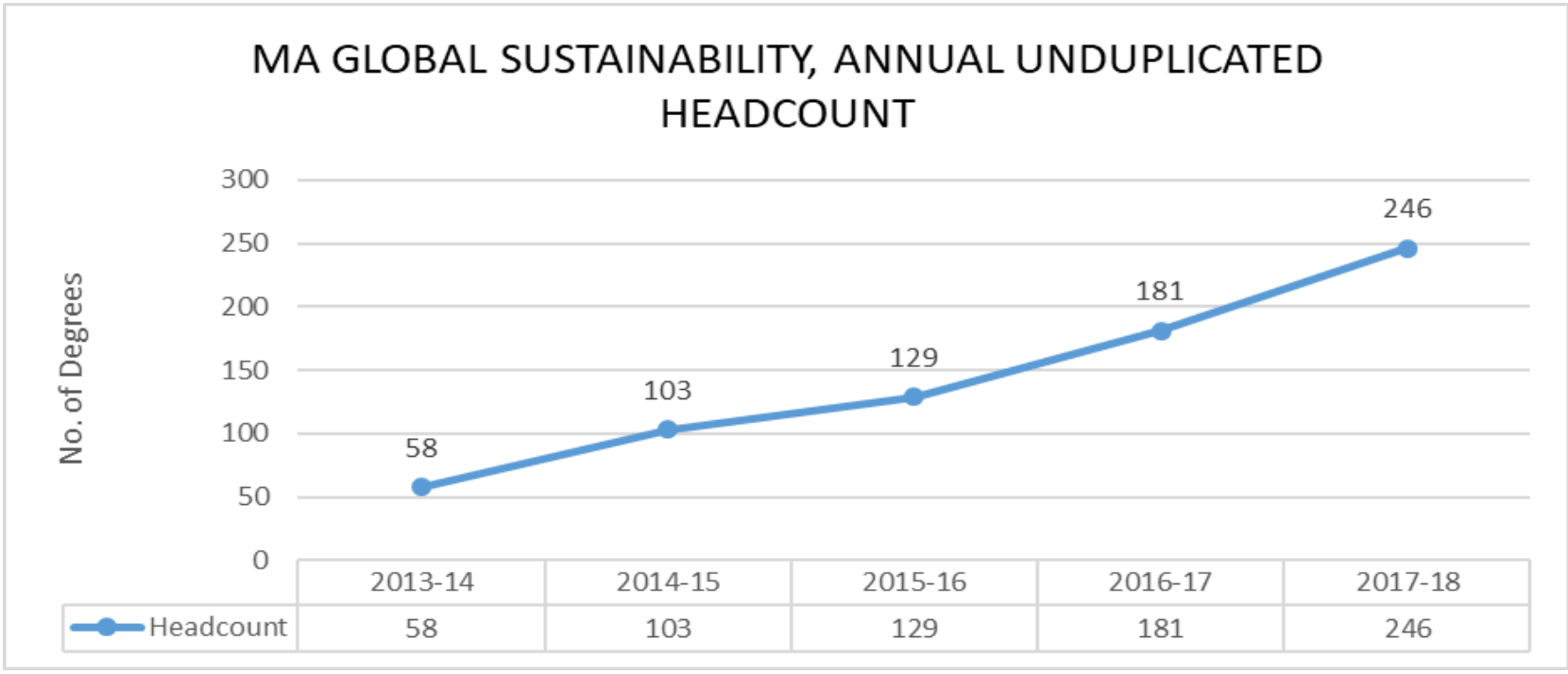
- Dr. Ashok K. Das, Founder and CEO, SunMoksha, India
- Caryle Cammisa, Foreign Service Officer, United States Agency for International Development
- Jeff Chernoff, Program Chair, Emerging Leaders of Tampa Bay
- Jason Mickel, Manager of Water Supply Section, Southwest Florida Water Management District
- Melissa Solberg, Sustainability Manager, Tampa International Airport
- Dr. Jurgen Kropp, Professor, Potsdam Institute for Climate Change Research, Germany
- Dr. Roy Crabtree, Regional Administrator, NOAA Fisheries Service
- Michelle Jenkins, Sustainability Coordinator, Hillsborough County Environmental Protection Commission
- Sheila McNamara, Sustainability and Security Manager, Hillsborough County
- Tom Lawery, Wholesale Renewables Manager, Duke Energy
- David Taylor, President, Taylor Future Solutions
- Dr. Tirusew Asefa, Manager of Planning & System Decision Support, Tampa Bay Water
- Rebecca Hooper, Education & Environmental Coordinator, Keep Tampa Bay Beautiful
- Michael Hewett, Director of Environmental and Sustainability Programs, Publix

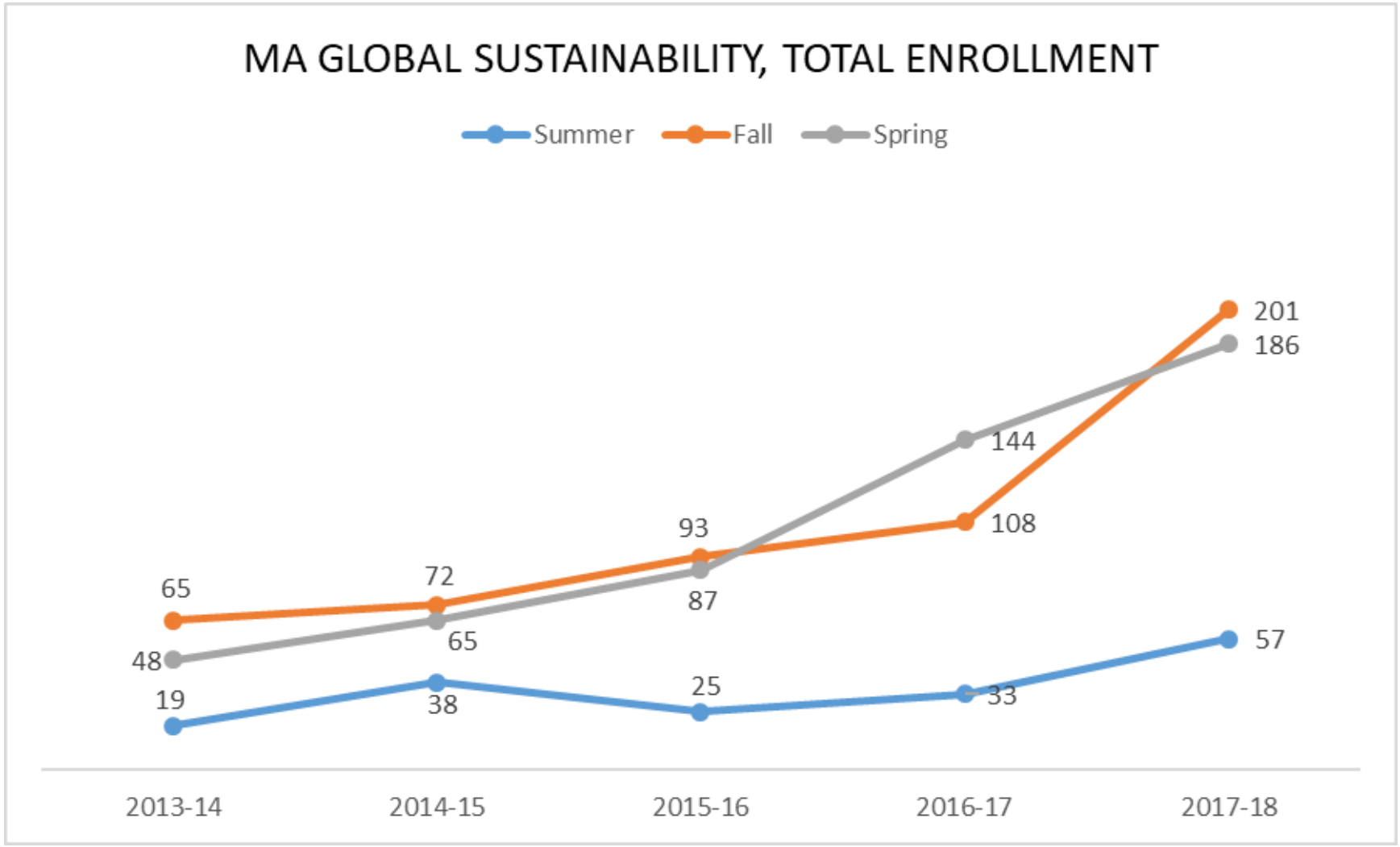
Admissions

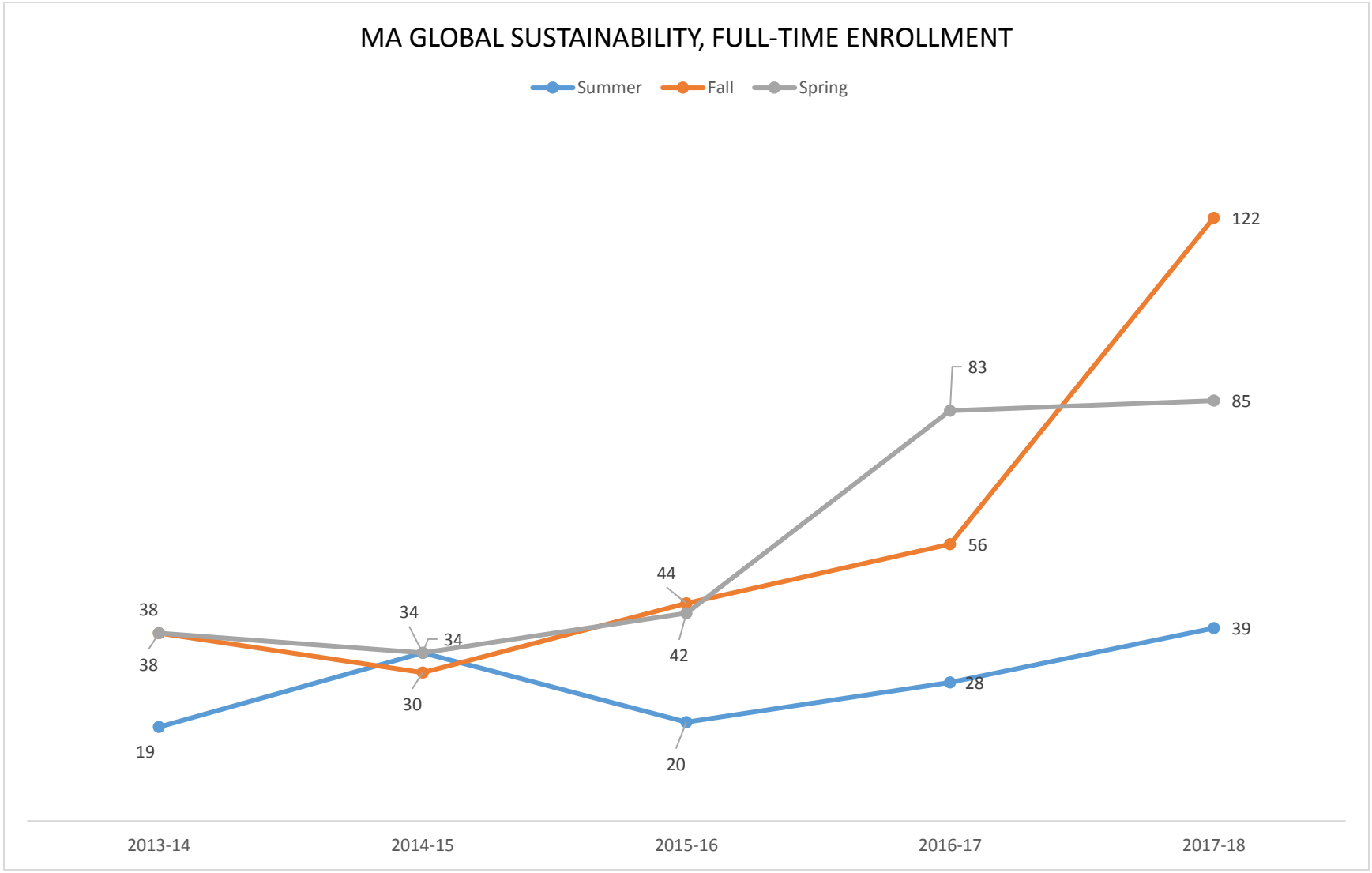
Graduate student recruitment and admission

The below Figures illustrate total MA student enrollment trends over the last five academic years. There has been a significant increase in the number of enrolled MA students, especially over the last two years. The last academic year (2017-2018) recorded enrollment is the largest in the history of the College. The College plans to maintain the MA student enrollment in the range of 150-200 graduate students until we can support larger enrollment by increasing our faculty and support staff.

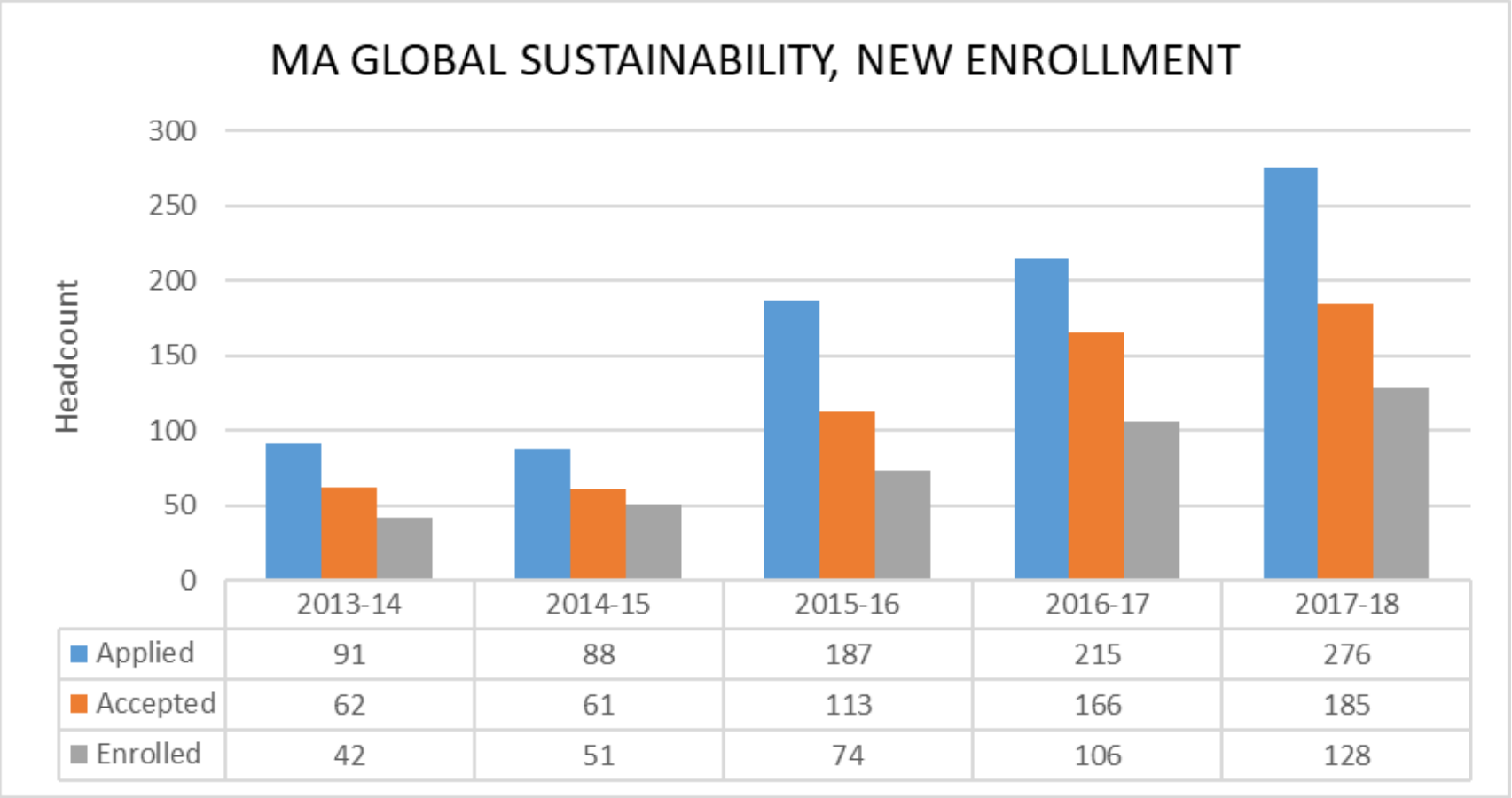
Projected enrollment for 2018-2019 is even higher as PCGS started offering summer courses in 2017 for the first time in our history due to increasing demand by students. This will increase SCH, reduce time to graduate, and provide additional opportunities for instructors, GAs and support staff during summer months.




MA GLOBAL SUSTAINABILITY, TOTAL ENROLLMENT
Summer
Fall
Spring
65
72
93
108
201
48
65
87
144
186
19
38
25
33
57
2013-14
2014-15
2015-16
2016-17
2017-18


MA GLOBAL SUSTAINABILITY, FULL-TIME ENROLLMENT
Summer
Fall
Spring
38
38
34
30
34
44
42
83
56
85
122
19
20
28
39
2013-14
2014-15
2015-16
2016-17
2017-18

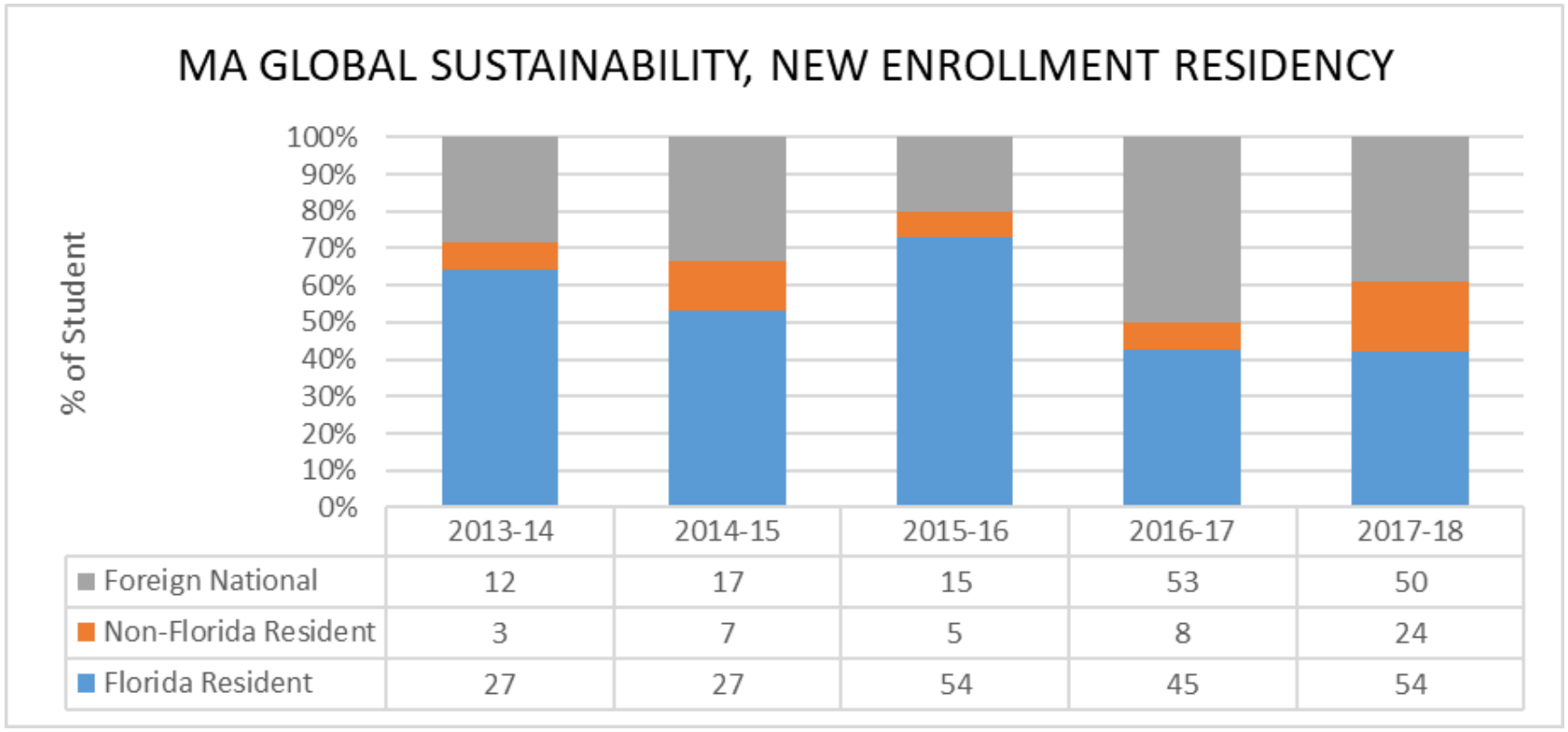
The below figure illustrates the admissions and enrollment trends over the last five years for new students. There has been steady new enrollment growth each year, and significant growth in new student numbers in both applications and new student enrollment the last two academic years.



	2013-14	2014-15	2015-16	2016-17	2017-18
Applied	91	88	187	215	276
Accepted	62	61	113	166	185
Enrolled	42	51	74	106	128

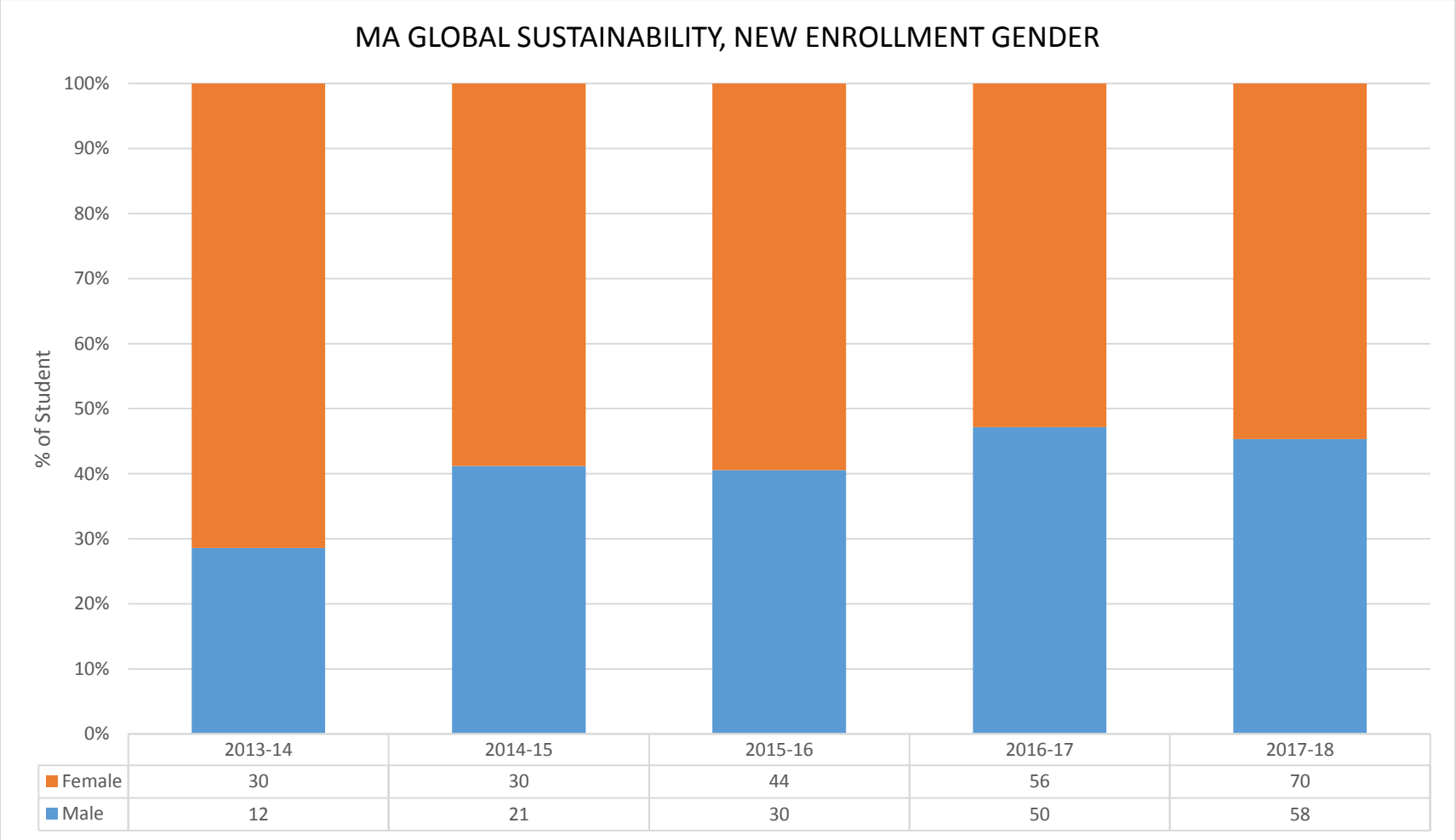
	2013-14	2014-15	2015-16	2016-17	2017-18
ENROLLED	**42**	**51**	**74**	**106**	**128**
GENERAL	9	3	4	19	28
WATER	14	15	15	9	7
ENTREPRENEURSHIP	13	9	15	19	18
SUSTAINABLE TOURISM	6	13	19	13	15
SUSTAINABLE ENERGY		11	20	18	12
COASTAL SUSTAINABILITY			1	5	9
SUSTAINABLE BUSINESS				15	9
SUSTAINABLE TRANSPORTATION				1	4
CLIMATE CHANGE				1	10
FOOD SUSTAINABILITY & SECURITY				6	16

The below figure illustrates the residency and enrollment trends over the last five years for new students. The Patel College of Global Sustainability has a significant percentage of non-resident and international students enrolled. The makeup of international students in the last five reported years has been at least 20% of our student body, and as high as 50% in 2016-2017.



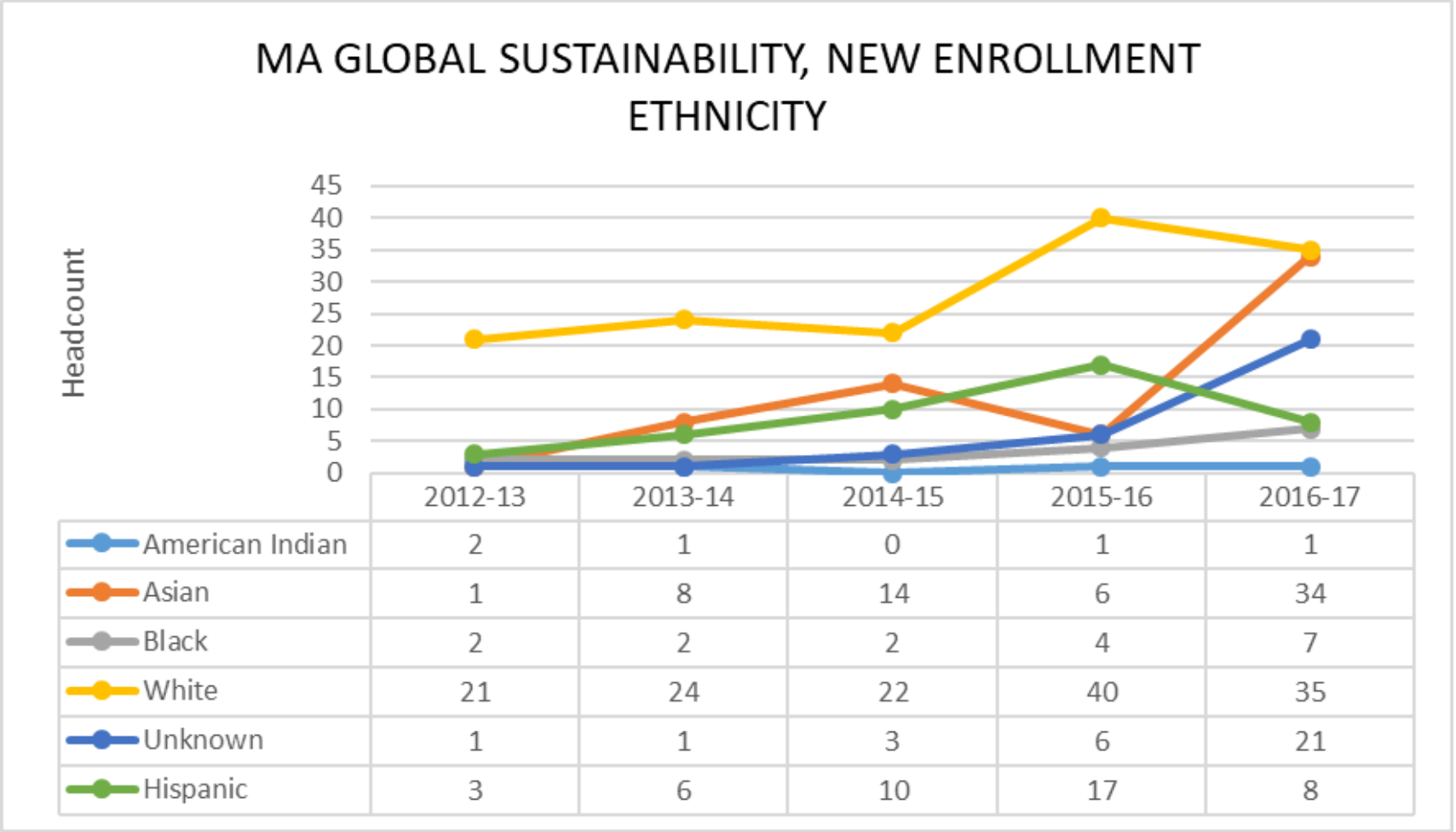
	2013-14	2014-15	2015-16	2016-17	2017-18
Foreign National	12	17	15	53	50
Non-Florida Resident	3	7	5	8	24
Florida Resident	27	27	54	45	54

The below figure illustrates the gender distribution in enrollment trends over the last five years for new students. PCGS has a significant percentage of female students (over 50%) every year, and as high as 70% females enrolled in the program (2013).



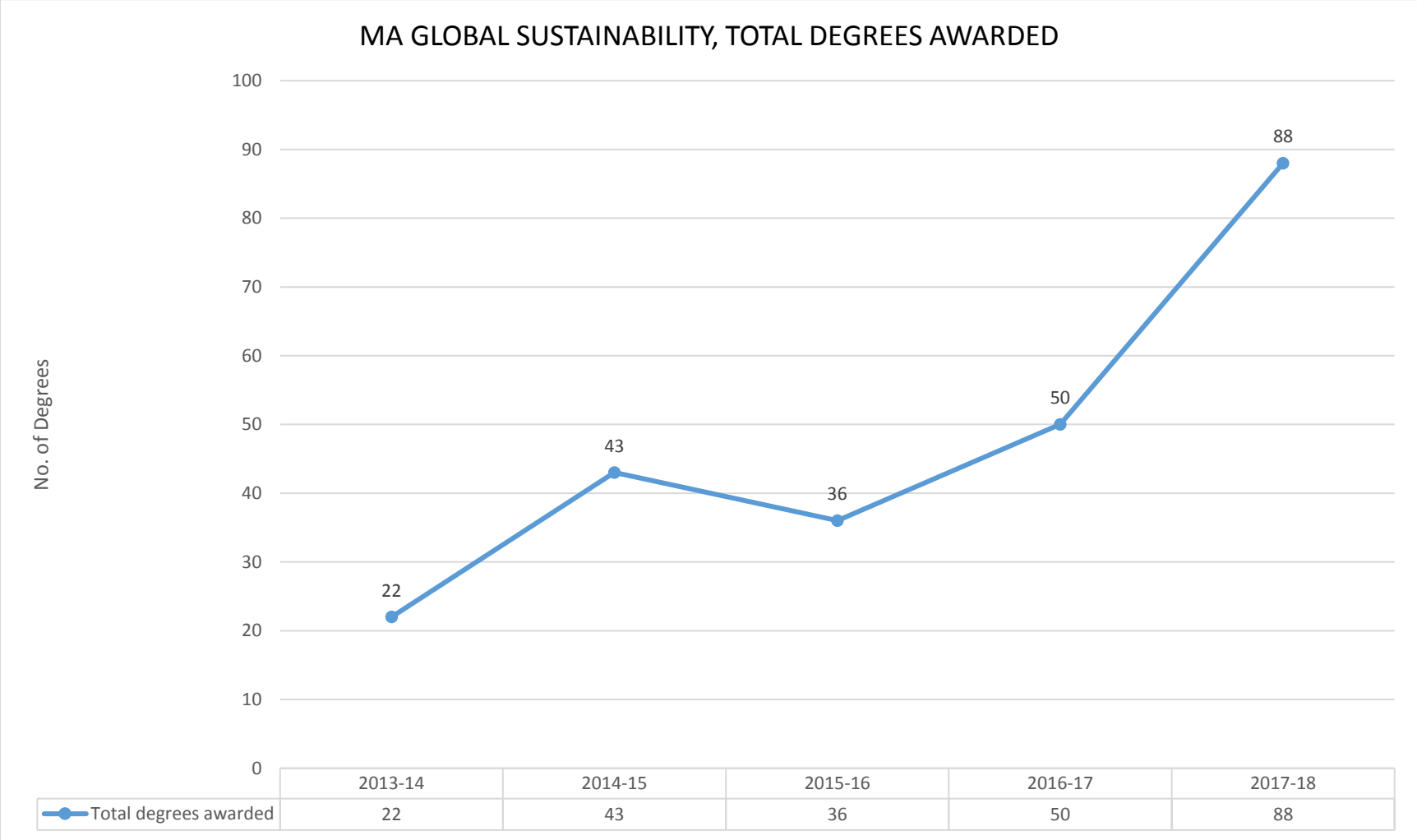
	2013-14	2014-15	2015-16	2016-17	2017-18
Female	30	30	44	56	70
Male	12	21	30	50	58

The below figure illustrates the ethnicity distribution for the MA student enrollment. One can observe from this figure that there was a direct correlation between international student enrollment growth and ethnicity growth. There has also been consistent growth of Black student enrollment each year and well as strong Asian student growth. White, Hispanic and American Indian student enrollment has fluctuated yearly. We expect the commitment of LAC scholarship funding to assist in Hispanic student growth in future years.

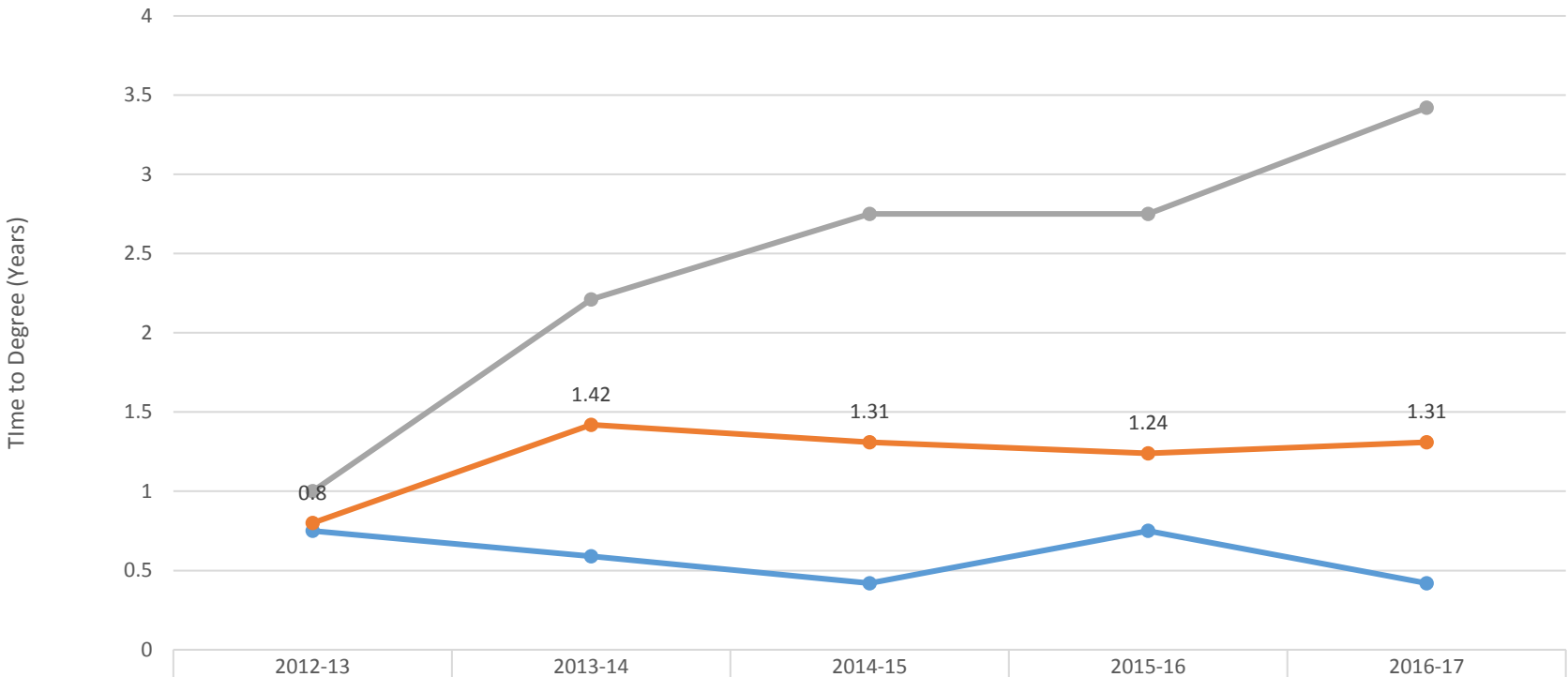


	2012-13	2013-14	2014-15	2015-16	2016-17
American Indian	2	1	0	1	1
Asian	1	8	14	6	34
Black	2	2	2	4	7
White	21	24	22	40	35
Unknown	1	1	3	6	21
Hispanic	3	6	10	17	8

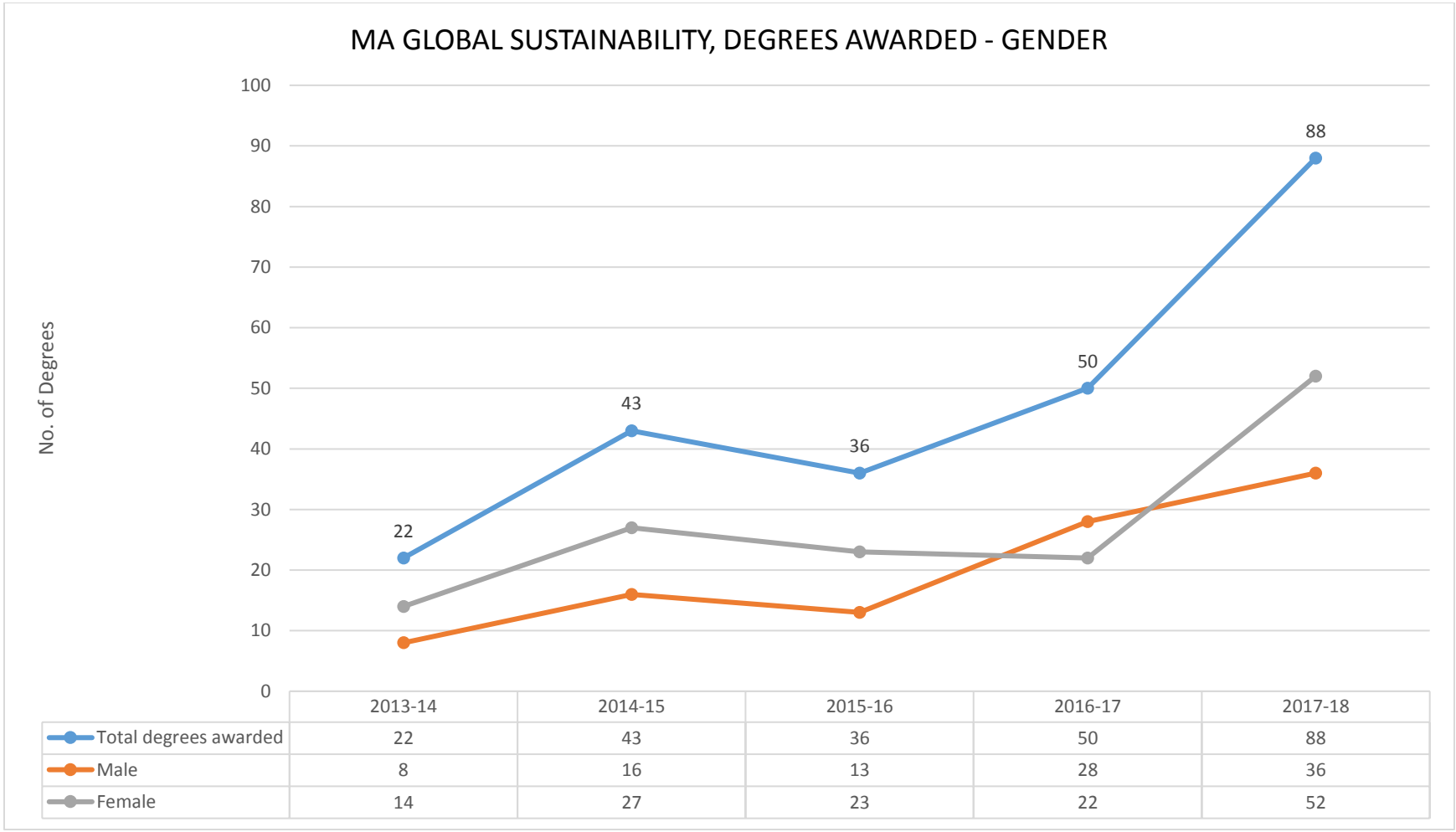
The below figures illustrate the degrees awarded trends the last five years as the program has also grown in admissions and enrollment. The largest enrollment for an academic year was in 2017-2018, and degrees awarded for 2018-2019 are projected to be the largest ever due to the mean time to degree completion.



MA GLOBAL SUSTAINABILITY, TIME TO DEGREE TRENDS



	2012-13	2013-14	2014-15	2015-16	2016-17
Minimum	0.75	0.59	0.42	0.75	0.42
Mean	0.8	1.42	1.31	1.24	1.31
Maximum	1	2.21	2.75	2.75	3.42



	2013-14	2014-15	2015-16	2016-17	2017-18
Total degrees awarded	22	43	36	50	88
Male	8	16	13	28	36
Female	14	27	23	22	52

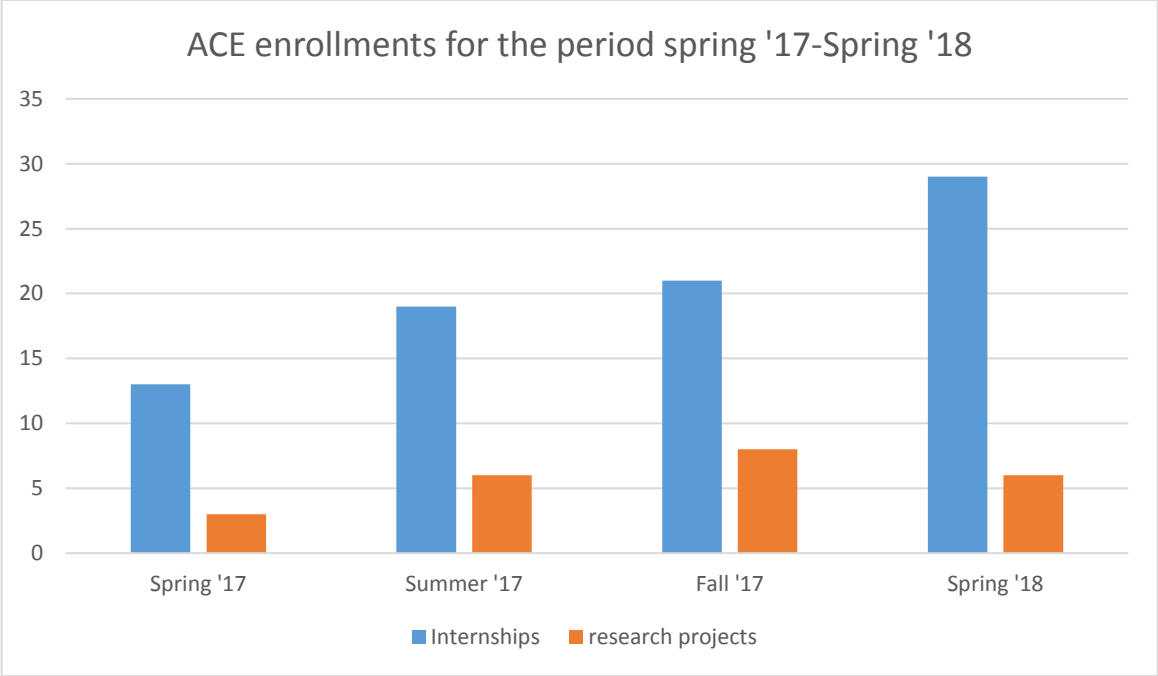
INTERNSHIP / RESEARCH PROJECTS

Our students conduct their internships at many exciting places across the globe. The Patel College of Global Sustainability internship program allows students to gain both international, regional and local perspective on sustainability while implementing program knowledge and research on-the-ground to solve real world problems.

This ACE program is typically completed the semester before the student graduates. This can be completed during spring, summer or fall.

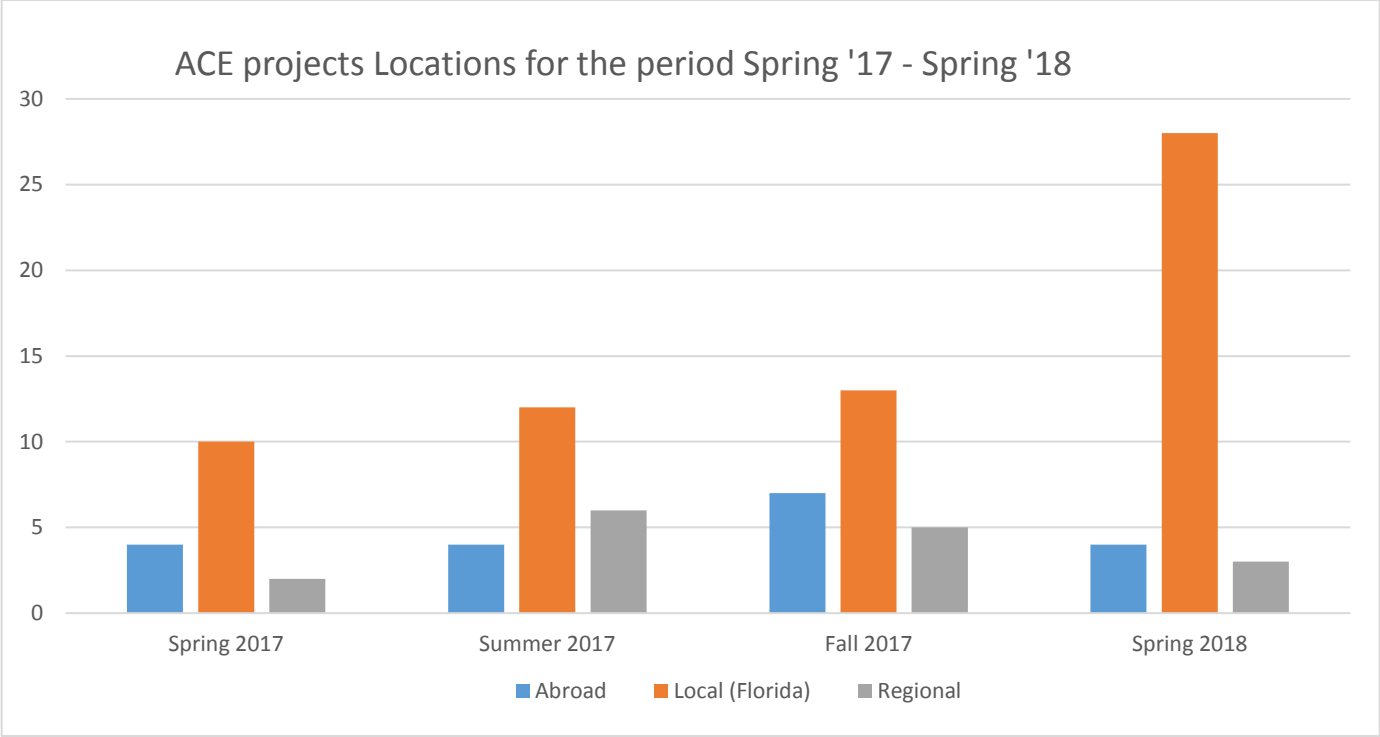
Below is a summary on the number of students who undertook their capstone project within the period of Spring 2017- Spring 2018

Semester period	**Internship**	**Research**	**Total**
Spring 2018	13	3	16
Summer 2017	19	6	25
Fall 2017	21	8	29
Spring 2018	29	7	36



The following graph summaries internships undertaken within the U.S, Abroad as well as local internships within Florida.

Semester period	International /Abroad	Local (Florida)	Regional (within US)
Spring 2018	4	10	2
Summer 2017	4	12	6
Fall 2017	7	13	5
Spring 2018	4	28	3


ACE projects Locations for the period Spring '17 - Spring '18
30
25
20
15
10
5
0
Spring 2017
Summer 2017
Fall 2017
Spring 2018
Abroad
Local (Florida)
Regional

Teaching and Research

Educational Programs

Master of Arts Program

The M.A. in Global Sustainability offers nine concentrations, all concentrations are available in a traditional on-campus format and online.

This program is designed to prepare students to address complex regional, national, and global challenges related to sustainability and the ability to innovate in diverse cultural, geographic, and demographic contexts. The Patel College of Global Sustainability strives to offer a dynamic curriculum, top-notch internship experiences, and overall superior education for our students.

BUILDING SUSTAINABLE ENTERPRISE

The M.A. in Global Sustainability concentration in Building Sustainable Enterprise will provide a foundation for designing sustainable organizations and businesses and related concepts pertaining to sustainability. Organizations and businesses from all sectors need to develop sustainable practices and models to minimize their environmental footprint and maximize their social responsibility to all stakeholders to meet the requirements of a sustainable, low carbon economy. The goal of this concentration is to provide participants with the knowledge, literacy, skills and tools they need to create more sustainable organizations.

CLIMATE CHANGE & SUSTAINABILITY

The concentration/certificate program in Climate Change and Sustainability will provide a strong foundation for students to advance their career by providing the knowledge and skills necessary to address regional, national and global challenges related to climate change. Students will also focus on the translation of policy and research into climate-smart mitigation and adaptation strategies for building sustainable and resilient communities through urban planning and sustainable urban development.

COASTAL SUSTAINABILITY

The M.A. in Global Sustainability concentration in Coastal Sustainability will provide knowledge of the history and development of the planning process and implementation, the global issues related to coastal planning including the nine planetary boundaries, and implementation strategies. Students will also be provided knowledge of community development with a particular focus on coastal habitat and marine environments.

SUSTAINABLE ENERGY

The Sustainable Energy Concentration educates students in the rapidly growing field of renewable energy, which already provides significant employment, entrepreneurship, investment, and trade opportunities. As the U.S. and world economies seek to become more sustainable, they are increasingly dependent on renewable fuels and power. Students will be prepared for private and public sector positions of leadership and responsibility in the biofuels, solar, wind, biomass, and other renewable energy sectors. The concentration is designed for students with a wide range of backgrounds, unlike similar-sounding programs at other institutions, which are designed for engineering and physical sciences majors.

SUSTAINABLE TOURISM

The M.A. in Global Sustainability concentration in Sustainable Tourism (6 credit hours) enables students to understand the relationships between tourism, society, culture and sustainability. Students develop the skills necessary to design a successful sustainable tourism strategy and development plan that is beneficial to business, coastal and marine habitats, and the local community. This can be completed online or on-campus.

ENTREPRENEURSHIP

The M.A. in Global Sustainability concentration in Entrepreneurship (6 credit hours) provides students with a comprehensive understanding of concepts, tools, and skills of sustainability and green technology. Focus areas include green technology, development, transportation, energy, and sustainable enterprise.

FOOD SUSTAINABILITY & SECURITY

The M.A. in Global Sustainability concentration in Food Sustainability and Security provides students with a solid understanding of key issues in food systems and safety/security.

SUSTAINABLE TRANSPORTATION

The M.A. in Global Sustainability concentration in Sustainable Transportation teaches methods for achieving a more sustainable transportation system and how that system fits into efforts to improve community design and the livability of urban areas.

WATER SUSTAINABILITY

The M.A. in Global Sustainability concentration in Water Sustainability (6 credit hours) enables students to understand the complex regional and global water- related sustainability challenges and to develop innovative, sustainable solutions specifically in the specializations of green infrastructure, urban water, and coastal issues.

Graduate Certificates

The Patel College of Global Sustainability strives to offer a dynamic curriculum, top-notch internship experiences, and overall superior education for our students.

Our graduate certificates offer students an abbreviated path to a specialization in sustainability. Graduate certificates can be earned in only 12 credit hours (four courses) and are perfect for professionals looking to enhance their skills and expertise, boost career advancement potential, and facilitate the advancement of new skills.

Certificates also functions as a gateway into the Patel College M.A. program as all credits can transfer directly into the degree program.

The Patel College currently offers eleven graduate certificate programs, four of which are offered fully online and on-campus.

BUILDING SUSTAINABLE ENTERPRISE

The Building Sustainable Enterprise graduate certificate will provide a foundation for designing sustainable organizations and businesses and related concepts pertaining to sustainability. Organizations and businesses from all sectors need to develop sustainable practices and models to minimize their environmental footprint and maximize their social responsibility to all stakeholders to meet the requirements of a sustainable, low carbon economy. The goal of this certificate is to provide participants with the knowledge, literacy, skills and tools they need to create more sustainable organizations.

CLIMATE CHANGE

The concentration program in Climate Change and Sustainability will provide a strong foundation for students to advance their career by providing the knowledge and skills necessary to address regional, national and global challenges related to climate change. Students will also focus on the translation of policy and research into climate-smart mitigation and adaptation strategies for building sustainable and resilient communities through urban planning and sustainable urban development.

COASTAL SUSTAINABILITY

This certificate program will provide a general foundation for coastal sustainability. It is designed to appeal to an audience with a wide range of backgrounds and interests in the planning, policy, and management fields. The certificate will be of particular interest to those related to sustainability students, and those involved with planning and management in coastal communities.

COASTAL SUSTAINABILITY MANAGANEMENT

This certificate program will provide a general foundation for coastal sustainability. It is designed to appeal to an audience with a wide range of backgrounds and interests in the planning, policy, and management fields. The certificate will be of particular interest to those related to sustainability students, and those involved with planning and management in coastal communities.

ENERGY SUSTAINABILITY

The certificate program will provide a general foundation in sustainability and thorough understanding of all forms of energy that can support a sustainable economy. It is designed to appeal to an audience with a wide range of backgrounds and career interests by addressing energy from all angles (technology, business, economics, policy, and social) unlike similar-sounding programs at other institutions, which are designed narrowly for engineering and physical sciences students.

FOOD SUSTAINABILITY

This certificate program will provide a general foundation in sustainability and a solid understanding of key issues in food systems and safety/security. The program will cover (1) the concepts, principles, economics, and finance of sustainability, as well as transition towards a green economy; (2) food production, distribution, marketing, disposal, and policy; and (3) food safety and security regarding biological, chemical, and physical threats. It is designed for an audience of a wide range of backgrounds with career interests in the field of food sustainability and security.

GLOBAL SUSTAINABILITY

This certificate program will provide a general foundation in sustainability and a solid understanding of key issues in food systems and safety/security. The program will cover (1) the concepts, principles, economics, and finance of sustainability, as well as transition towards a green economy; (2) food production, distribution, marketing, disposal, and policy; and (3) food safety and security regarding biological, chemical, and physical threats. It is designed for an audience of a wide range of backgrounds with career interests in the field of food sustainability and security.

SUSTAINABLE TOURISM

This certificate program will provide a general foundation of sustainable tourism and related concepts of sustainability. It is designed to appeal to an audience with a wide range of backgrounds and interests in the tourism and hospitality industry. The curriculum will be of particular interest to those related to global tourism movements such as the United Nation's World Tourism Organization, the International Ecotourism Society, and the Global Sustainability Tourism Council.

SUSTAINABLE TOURISM LEADERSHIP

This certificate program will provide a general foundation of sustainable tourism and related concepts of sustainability. It is designed to appeal to an audience with a wide range of backgrounds and interests in the tourism and hospitality industry.

SUSTAINABLE TRANSPORTATION

The M.A. in Global Sustainability certificate in Sustainable Transportation teaches methods for achieving a more sustainable transportation system and how that system fits into efforts to improve community design and the livability of urban areas.

WATER SUSTAINABILITY

The M.A. in Global Sustainability certificate in Sustainable Transportation teaches methods for achieving a more sustainable transportation system and how that system fits into efforts to improve community design and the livability of urban areas.

Interdisciplinary research in PCGS

The Patel College of Global Sustainability conducts applied research that creates sustainable solutions in a rapidly-changing world. The research is based upon USF's broad, interdisciplinary expertise in the areas of energy, water, public health, global security, and social equity. This interdisciplinary approach provides a fertile foundation for the development of unique solutions to emerging and existing problems.

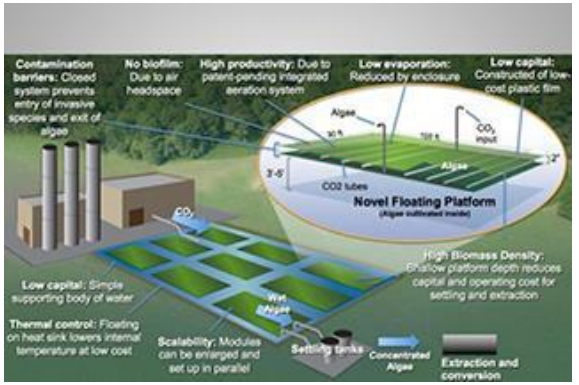
Key Research Areas

- Renewable fuels and products
- Global change and the associated uncertainties
- Urban form and its influence and impact on resource management
- Urban metabolism – modelling resources flows (water, wastes, energy, people, goods....)
- Urban water – integrated urban water modelling, flexible design, transitioning
- Sustainable Tourism – Participation in the global research of the UNWTO International Network for Sustainable Tourism Observatories.

Focus Areas

Algae Technology

Algae represent a promising source of alternative fuels and bio-products, but with the added benefit of serving as a sink for carbon dioxide and wastewater. Using our experience in algae engineering for the production of chemicals and fuels, we use native algae strains in our lab and outdoor facilities to generate and commercialize algal products under real-world conditions. Algae synthesize omega-3 fatty acids, which are essential to human nutrition and health. Algal lipids can be converted to biodiesel and jet biofuel via chemical processing, whereas phospholipids (found in algal cell membranes) are valuable in the cosmetics industry. Live algae fed to fish result in higher aquaculture production and algal protein can serve as animal feed and fish meal. Our applied research closes the gap between innovative ideas and the marketplace.



Our efforts are focused on:

- Design of cost-effective cultivation platforms
- Scale-up and operation of algae production systems
- Water, nutrient, and energy management
- Product development (fuels, cosmetics, nutraceuticals)
- Intellectual property management

Biofuels and Bioproducts from Biomass

Biomass is an abundant and inexpensive domestic feedstock for bio-refineries designed to produce value-added products and clean power. Florida generates sugarcane bagasse and yard waste in South Florida, citrus peel and agricultural residues in Central Florida, and woody biomass in Northern Florida.

We test and optimize the conversion of various biomass species, such as sweet sorghum and sugarcane bagasse, to sugars in scalable and cost-effective ways through biochemical conversion. First, biomass is pretreated using mild conditions and green chemistry principles. Then, cellulase enzymes are employed to convert cellulose to simple sugars. Those sugars can form the basis of a sustainable green economy, as they are readily convertible via fermentation to a variety of chemical precursors, such as organic acids, for the manufacture of biofuels, plastics, resins, and other renewable products. In essence, biomass can replace oil as the source of chemicals essential for consumer products.

Small-scale fermenters fully equipped with control systems are operated in the lab. A bio-refinery pilot plant has been designed and operated in partnership with a sugar company inside one of its sugarcane mills in Florida. It provides USF and its collaborators with unique process development and scale-up capabilities in a real-world environment.

Biodiesel and Jet Biofuel

Fuel diversification is needed for diesel and jet engines. The United States consumes 57 billion gallons of diesel and 20 billion gallons of aviation fuel annually, hence depending significantly on foreign oil. Such dependence renders the United States vulnerable to political instability around the world. Domestic biofuels can make the country more energy self-sufficient.

We have technical and business expertise in biofuel production with a focus on sustainable technologies and resources:

- Biodiesel production using supercritical fluid technology
- Biodiesel from used vegetable oils
- Biodiesel from algal lipids
- Jet biofuel from *Brassica carinata*

Production of biofuels is conducted in batch and continuous modes. We are available to assist entrepreneurs, companies, and communities in the production, distribution, and marketing aspects of their biofuel business.

Transitioning Urban Infrastructure

The need for transitioning of Urban Infrastructure Systems (UIS) is illustrated by the facts that the earth system is undergoing significant rapid changes which have developed from increased human activities, population growth and urbanization (Vairavamoorthy et al., 2008). Whereas 48% of the world's population presently live in cities and towns, this proportion is expected to increase to about 60% in the year 2030 aggravating the need for the transition of existing systems.

To ensure a more sustainable future there is a need for more drastic measures. Technology breakthroughs and innovative designs need to be coupled with comprehensive system changes to the urban processes, institutions, and regulations that ultimately shape our cities. Cities will be faced with difficult future strategic decisions (e.g. the choice between centralized and the decentralized systems; the choice regarding the level of involvement of individual citizens, NGOs and companies; the choice between an institutional framework where separate institutions are responsible for a certain element of the urban infrastructure system or moving towards a more integrated institutional set-up). Hence it is likely that future desired UIS will look and operate differently to existing ones and will be managed and financed differently.

Focus Area

From Gray to Green: Tools for Transitioning to Vegetation-Based Stormwater Infrastructure'.

Funder: US Forest Service, National Urban and Community Forestry Challenge Program.
Goal: This project will provide natural resource managers, planners, and engineers with a set of decision support tools to aid the strategic planning process for transitioning to green infrastructure systems that emphasize trees and urban forests.

This project develop and demonstrate an innovative transitioning framework from gray to green infrastructure systems for urban watersheds through the execution of the tasks outlined below and illustrated in the figure below.

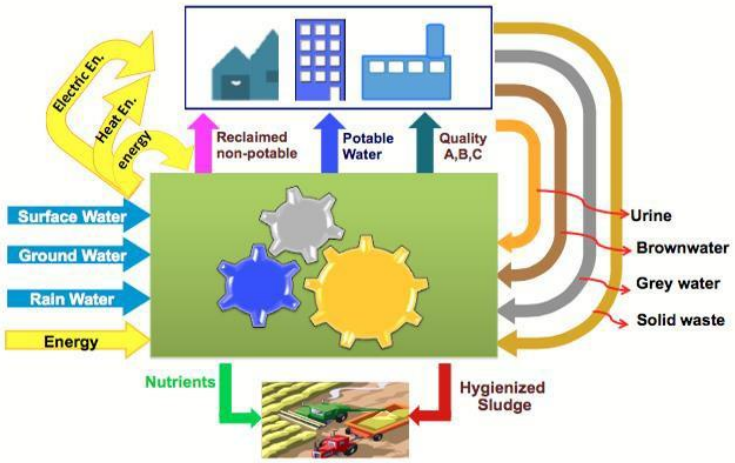
Outcome: PCGS has developed an open-source, Gray to Green (G2G) Decision Support Tool (DST) to aid the strategic planning process for transitioning from Gray (pond and pipes) to green infrastructure systems. G2G consists of three primary components: 1) a modified version of the EPA's BMP Siting Tool that will provide a GIS-based mapping tool to identify areas suitable for green infrastructure, factoring in site conditions and existing drainage systems at the scale of the stormwater catchment; 2) an optimization tool to identify an optimal mix of existing gray and new green infrastructure to achieve runoff quantity and quality goals, given site constraints, and key secondary social and ecological benefits (e.g. shade, heat-island mitigation, noise abatement); and 3) a decision support tool to help users select the preferred combination of gray and green options to define a stage-wise implementation process. When used in combination, the toolset will identify a prioritized, optimal transition pathway from gray to green infrastructure.

Recently, the entire suite of G2G toolset has been applied for the neighborhood surrounding the intersection of N. 47th Street and Frierson Avenue in Tampa, Florida. G2G is employed to evaluate alternatives to expanding an existing stormwater retention pond to relieve acute and chronic flooding in an approximately 31-acre drainage basin with no known outfall (closed drainage basin). The outcome showed that green infrastructure and water sensitive urban design approach provide options that restore the natural system and minimize flood impacts while improving other ecological benefits (e.g. Co2 sequestration, shade, heat-island mitigation, noise abatement). The toolset, corresponding guidelines and training materials will be applied in Milwaukee (Wisconsin) in May 2017.

Integrated Urban Water Management

The global challenges of rapid urbanization and climate change adaptation in the midst of growing water scarcity is driving the need for a paradigm shift to Integrated Urban Water Management (IUWM

IUWM is an approach that includes: interventions over the entire urban water cycle; reconsideration of the way water is used (and reused); and greater application of natural systems for water and wastewater treatment. It provides an alternative to the conventional approach for an effective and efficient management of scarce water resources.



Focus Area

Integrated Urban Water Management Toolkit (IUWM Toolkit)

Funder: Global Water Partnership (GWP) Goal: The main goal of this project is to enhance awareness of decision makers, senior managers and practitioners on the concept and approach of IUWM and at the same time to provide the necessary tools and guidance in developing strategies and implementing IUWM on the ground.

Outcome: PCGS in collaboration with the Global Water Partnership (GWP) and the World Bank (WB) has developed IUWM Toolkit and Training Package to provide an integrated solutions to water supply, sanitation and drainage challenges. IUWM Toolkit includes six main components: diagnostic tool, technology selection tool, water balance tool, stakeholder engagement guideline, institutional mapping tool, and economics and finance tool. The toolset has also been used to develop a three level IUWM Training Package that include training module for decision makers, managers and practitioners. The IUWM Toolkit and Training Package have been applied in many countries. Some of them are listed below:

- ***Abidjan, Cote d'Ivoire:*** PCGS, in collaboration with GWP, provided a half-day "Awareness Raising Introductory Session" on IUWM where the concepts and principles of IUWM were introduced to a high level audience including representatives from the African Development Bank (AfDB) and African Water Facility (AWF). In addition, a 2.5 day "IUWM Capacity Building Program" designed for 25 professional staff of the AFW, AfDB and regional GWP staff was hosted in Abidjan.

- ***Ulaanbaatar, Mongolia:*** PCGS provide IUWM workshop for a high level meeting at the State Palace of the Republic of Mongolia with the participation of 60 participants including 2 Ministers and the Vice Mayor of Ulaanbaatar. It was followed by a three day workshop outside the capital city and then followed by a debriefing at the Mayor's building with the Vice Mayor, the Governor of the Tuwan Province, and the Director of the association of Mayors of Mongolia.

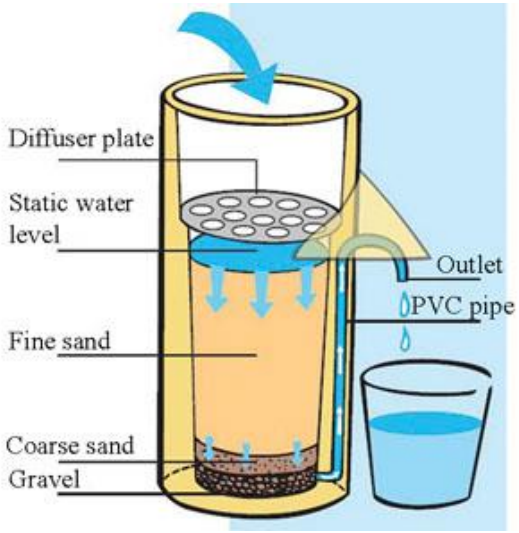
- ***Seychelles:*** PCGS is involved in the development of a comprehensive sanitation master plan for Seychelles. The master plan is based on an Integrated Urban Water Management (IUWM) approach, which will identify and utilize links and synergies with other infrastructure sectors – water supply, drainage, solid waste and energy – and other concerned areas like agriculture, land use planning, tourism and economic development.

- ***Mozambique (Inhambane and Chimoio Towns):*** The Africa Water Facility / African Development Bank approved a Grant of $1,700,000 on July 2016, for the project Development Plan and Feasibility Study for Urban Sanitation, Drainage and Solid Waste Management in Chimoio and Inhambane. The project is aimed at improve climate change resilience and socio economic development in the provincial capitals of Chimoio and Inhambane. PCGS is providing technical support to the Implementing Agency which will host the Project Implementing Unit (PIU) and the Project Technical Committee and the Consultant to ensure that the IUWM approach and related considerations are mainstreamed in the implementation of the Project.

- ***Marondera (Zimbabwe) and Madagascar:*** Based on the PCGS IUWM project outcomes and diagnostic studies conducted in many countries, the African Development bank funded $2,000,000 (for each countries) to develop sanitation master plans for eight cities in Madagascar. The goal is to reach healthier cities through an IUWM. PCGS will provide technical advice on how to integrate IUWM in to the sanitation master plan under development.

Water and Wastewater Treatment

Globally close to a billion people do not have access to safe drinking water and more than 2.6 billion lack appropriate sanitation, mostly in developing countries. This has led to widespread public health issues and environmental pollution. One of the major reasons leading to these issues is lack of affordable and appropriate technologies for water and wastewater treatment. Researchers at the Patel College of Global Sustainability are trying to address some of these through the development of efficient and low cost technologies for water and wastewater treatment.



Focus Area

Appropriate technologies for water and wastewater treatment

Some of the research activities in this area include the following: Enhancing the design and performance of the conventional biosand filter technology for household water filtration, modifying locally available filter media to remove multiple contaminants such as fluoride, arsenic, pathogens, applying indigenous biomaterials (seeds of Moringa tree) for water and wastewater treatment, and developing modified systems of onsite wastewater treatment for pathogens and nutrients removal.

Faculty Publications

Culhane, Thomas. H., et al. (2018) "Cold Climate Adaptations for Household Level Biodigestion: Food Waste to Fuel and Fertilizer Research in Portugal, Pennsylvania, New York and Germany," *Journal of Environmental Engineering and Science* 2018 (in press) (originally presented in Proceedings of International Conference on Alternative Fuels, Kayseri University, Turkey, December 2016).

Culhane, Thomas H., et al. (2018) Indoor Bathroom, Kitchen and Basement Biodigesters: Cold Climate Adaptations for Household Level Biodigestion," *Journal of Environmental Engineering and Science* 2018 (in press).

Deshpande, S., Sunol, A., **Philippidis, G.** "Status and Prospects of Supercritical Transesterification for Sustainable Biodiesel Production", *WIREs Energy Environment*, 2017, e252. doi: 10.1002/wene.252 (2017).

Dorsey, Joseph W. and Leon C. Hardy. "Sustainability Factors in Dynamical Systems Modelling: Simulating the Non-Linear Aspects of Multiple Equilibria." in *Ecological Modelling*, 368:2018, pp. 69-77.

Goyal, G., Kuhn, J.N., **Philippidis, G**. "Light olefin production by cracking *Picochlorum oculatum* microalgae using aluminosilicate catalysts", *Biomass Bioenergy,* 108, 252-257 (2018).

Jayantha Obeysekera, J., Graham, W., Sukop, M., Asefa, T., Wang, D., **Ghebremichael, K**. and Mwashote, B. (2017) Implications of Climate Change on Florida's Water Resources: In Jones et al., Ed. *Florida's Climate: Changes, Variations & Impacts,* Florida Climate Institute, ISBN 13-978-1979091046.

Mompremier. R., Fuentes Mariles O.A., **Ghebremichael**, **K,** Silva Martínez, A.E., Becerril Bravo, J.E (2018). Study of the variation of haloacetics acids in a simulated water distribution network, *Journal of Water Science and Technology: Water Supply*, 18(2) (DOI 10.2166/ws.2018.055)

Mompremier. R., Fuentes Mariles O.A., **Ghebremichael**, **K,** Silva Martínez, A.E., Becerril Bravo, J.E (2018). Study of the effect of pipe materials and mixing phenomenon on trihalomethanes formation and diffusion in a laboratory-scale water distribution network, *Journal of Water Science and Technology: Water Supply* 18(1) 183-192

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Philippidis, G. "Advancing Energy Security and Economic Growth with Biofuels" in *Energy Security and Environmental Sustainability in the Western Hemisphere*, Lexington Books, Lanham MD, 381-391 (2017).

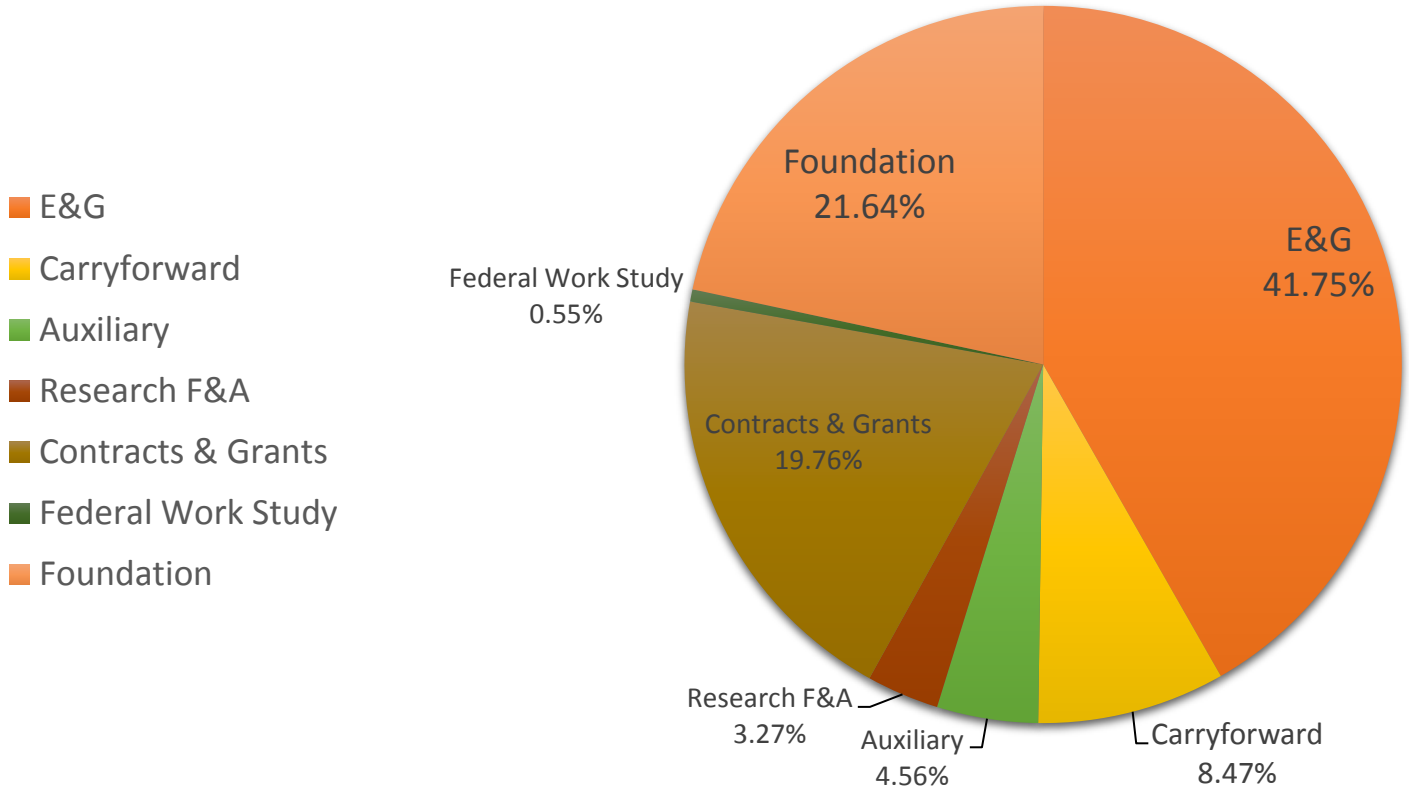
Pirasaci, T., Manisali, A.Y., Dogaris, I., **Philippidis, G**., Sunol, A.K. "Hydrodynamic design of an enclosed Horizontal Bioreactor (HBR) for algae cultivation", *Algal Research*, 28, 57-65 (2017).

Yassin, M., Mahmoud, N., **Ghebremichael**, **K** and Petrusevski, B (2017). Assessment of a roughing filtration as a pre-treatment for slow sand filtration of canal water with highly variable feed water turbidity, *Desalination and Water Treatment*, 79: 221-227

FY2017-2018 FUNDING OVERVIEW

Funding Source	FY2017-2018 Allocation/Revenue		Total Projected Expenses FY2017-2018
E&G	$ 1,137,172		$ 1,137,172
Carryforward	230,655		110,500
Auxiliary	124,258		80,862
Research F&A	88,962		64,779
Contracts & Grants	538,234		127,979
Federal Work Study	15,000		15,000
Foundation*	589,395		270,210
	$ 2,723,676		**$ 1,806,502**

2017-2018 Allocation/Revenue



**Additional Foundation Funds of $3,449,007 as follows:

Endowments-$3,207,988

Foundation Construction Fund-$241,019