March 2021 #104

# SURVEYING +SPATIAL

## Magazine



GIS – UPSKILLING FOR THE FUTURE

SURVEYING AND SURVIVAL ON MOUNT KILAUEA

DIGITAL SHIELDS – INNOVATIVE NEW TECHNOLOGY

# Refreshing your skill set

*Rachel Harris*



As the world makes headway out of lockdowns and into economic recovery, many people are turning their attention to their careers and professional development to future-proof and add value to their current skill sets.

In this edition, we look at moving ahead both professionally and as an industry, a timely theme in the post-Covid recovery phase and as the survey and spatial industries continue to evolve and adapt to the future with new innovations and technology.

In the wake of Covid-19, many people are reassessing their professional lives, looking at greater flexibility in the way they work and ensuring their career is more adaptable and future-oriented.

One of the few positives that has come out of the pandemic lockdowns has been a chance for people to re-evaluate their career skills, professional roles and consider new ways to diversify their skill sets.

Although New Zealand has for the most part emerged relatively unscathed from the global fallout of redundancies, reduced working hours and restricted working environments, many professionals are now looking at new opportunities, switching sectors, retraining, or setting up their own businesses.

In these uncertain economic times, it certainly seems to make sense to pursue a broad portfolio of skills and reach out to your professional network. There are many avenues you can take to learning new skills, including professional development courses, online learning modules and courses through established tertiary providers.

Survey + Spatial NZ also has some excellent workshops, seminars and webinars under way, as well as the forthcoming 2021 conference in Auckland which has an outstanding presentation programme scheduled as well as excellent networking opportunities for attending delegates.

Get involved with your professional organisations and membership bodies, gain support from other professionals in your field and become active in their group endeavours and events, or stay local within your region, attend branch meetings and get up to date with the latest issues, local discussions and workshops (Survey + Spatial NZ has 16 branches nationwide).

With plenty of opportunities for broadening your professional and career horizons across many different organisations and platforms, now is the perfect time to continue to progress and evolve your professional skills for the survey and spatial industries.

In this edition of *Survey + Spatial* we feature a topical article by Duane Wilkins on adding GIS skills to your professional skill set.

In the wake of Covid-19, many people are reassessing their professional lives, looking at greater flexibility in the way they work and ensuring their career is more adaptable and future-oriented.

With an increasing demand for GIS skills and a current skills shortage in New Zealand, skills in data management, feature analysis, integrating data as well as presenting GIS applications are becoming increasingly valuable skills across many industries. Duane takes a look at how you can add GIS skills to your toolbox and what learning options are available to develop your skill set and knowledge.

SITECH NZ reports on an innovative, new digital shield project for KiwiRail that increases operator safety and protects rail lines and structures during civil works. The digital shield technology has prompted an enthusiastic response from the industry, ensuring safer civil operations and further potential application across other sectors of the industry.

Ensuring your business is working smartly and efficiently in 2021 is the topic of discussion in our business management feature in this edition. With another extraordinary survey adventure encountered in the line of duty, Peter Otway recalls his fortuitous escape from an eruption on Hawaii's Mt Kilauea.

And in our Personal Perspectives column, Senior Survey Adviser Toni Hill reports on her personal experiences on joining the Office of the Surveyor-General and the new developments and projects under way at LINZ. ●

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**EDITOR**
Rachel Harris
*surveyingspatial@gmail.com*

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The Chief Executive
Survey and Spatial New Zealand
PO Box 5304
Lambton Quay
Wellington 6140
New Zealand
Phone: 04 471 1774
Fax: 04 471 1907
Web address:
*www.surveyspatialnz.org*
Email: *admin@surveyspatialnz.org*

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*info@kpm.co.nz*

**TO ADVERTISE**
Email: *admin@surveyspatialnz.org*
or contact Jan Lawrence
+64 4 471 1774

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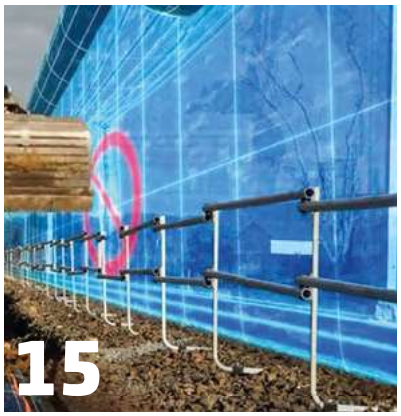
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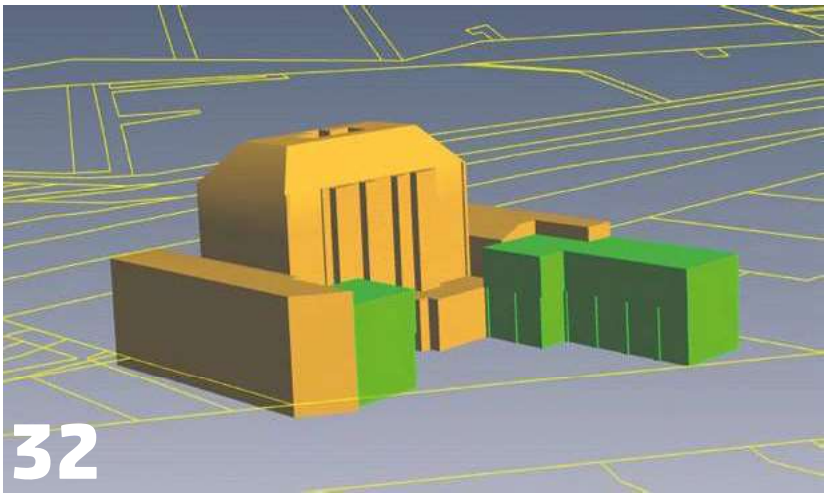
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# OPTIONS FOR ADDING GIS TO YOUR SKILLS TOOLBOX

*Duane Wilkins, Senior Adviser Geospatial Capability Building, Land Information New Zealand*

In 2008, I directed a programme for the United States Agency for International Development (USAID) to establish city and infrastructure mapping teams in 20 cities in the Middle East. We employed more than 80 engineers who could demonstrate familiarity using AutoCAD and we taught them how to use and apply geographic information systems software, data, tools and related technologies.





**Survey plan sources and scanning by engineer Ammar Dosky. Photos: Survey Spatial**

We provided scanners, printers, computers, differential Leica GPS, and a range of survey tools to help scan and align rapidly deteriorating paper and goat skin survey plans with satellite imagery to develop a basic parcel/title layer, which became the basis for identifying landowners, infrastructure and utilities.

We couldn't have large gatherings or team meetings as H1N1 influenza, or swine flu, was spreading rapidly throughout the community, causing great uncertainty, and with many working from home. Over a year, we had only a few days together face to face, and generally kept in touch via Skype, and audio conferences. Sounding familiar?

The engineers had an overwhelming desire to learn new skills and knew they needed GIS for the task; they also had to overcome a number of overwhelming challenges. We were very fortunate to have scanned all of the historical survey plans because they were all lost to fire when ISIS burnt out most of the regional government buildings. Fortunately we had copies of most of the data squirrelled away all around the world on USB drives.

Long story short: If Iraqi engineers working in a post-conflict, civil war zone with sketchy satellite internet and no wifi, reliant on diesel generators, generally in temperatures of 30 to 50 Celsius, could become proficient in GIS in spite of ISIS in Iraq (who destroyed their offices and all the old maps), then you can too.



**Getting ready for a Sunday drive across Baghdad to talk about GIS with local engineers, 2009.**

## Eight(ish) reasons you might like to add GIS to your skills toolbox

**FAMILIARITY:** If you're familiar with surveying or engineering software, you are very likely to already know more than most GIS analysts about

Long story short: If Iraqi engineers working in a post-conflict, civil war zone with sketchy satellite internet and no wifi, reliant on diesel generators, generally in temperatures of 30 to 50 Celsius, could become proficient in GIS in spite of ISIS in Iraq (who destroyed their offices and all the old maps), then you can too.

projections, datums and coordinate systems, so it makes sense to build on the knowledge you already have.



**Many GIS users have difficulty understanding datums and projections. PS: When oranges are not working, we also try pear shaped (bad dad joke).**

**RAIN:** GIS people are always in high demand during disasters, and emergencies are becoming more frequent. Most GIS work can now be performed remotely, on remote servers or desktop PCs.

**42:** GIS will help map the answer to "the ultimate question of life, the universe and everything". It has been applied to thousands of situations, within almost every sector of work from health mapping, restaurant location planning, 3D visualisations of forestry and flood mapping. Check out this amazing list of 1000 uses of GIS from Agriculture to Weather: *hae.re/1000*.

**FREE:** GIS software is incredibly accessible, there are a variety of options to suit your interests, from storytelling with Google Earth Pro (free), desktop analysis with open source desktop QGIS (free), to deploying integrated online tools with Esri ArcGIS Online (free, trial, personal and NGO licence options).

**DATA:** There are petabytes of New Zealand geospatial data freely accessible from most agencies like LINZ, DOC, MFE, Stats NZ, Manaaki Whenua, NIWA, GNS Science, most councils, and *data.govt.nz* is a great place to start your quest.

**YOUTUBERS:** There are a huge variety of online resources to help you learn GIS skills, including 1,050,000 video tutorials on YouTube *hae.re/tutorials*, online webinars, free and low cost online courses, university courses and professional development training available. You can also view our growing collection of GeoBites video recordings here: *hae.re/webinars*.

**DEMAND:** Good GIS help is hard to find. GIS skills are listed on the New Zealand immigration skills shortage list under 'Spatial Scientists' of various types. Skills in managing data, analysis of relationships between features, and integrating data from different sources using GIS and then being able to create summary reports, communicating by creating interactive StoryMaps and creating online dashboards are a desirable skill, readily applied to most sectors. *skillshortages.immigration.govt.nz/*. Search: *Spatial Scientist*.

**FUN:** Now with 50 per cent more added colour! Are you tired of black backgrounds and grey user interfaces? Do you wish everything could use a rainbow palette? Understanding the art and science of colour use in mapping is important, and a useful skill when painting your house too. Have a look at this LiDAR 3D viewer of Paeroa at OpenTopography.org: *hae.re/tree*.

**MONEY.** In these uncertain economic times affected by Covid-19, it's always useful to have a few backup skills that can help you step out of your normal role. Skills in data analysis can make you a very valuable resource for contracting or a little extra work on the side, levering your unique skill set in the growing area of data analytics, and analysis.

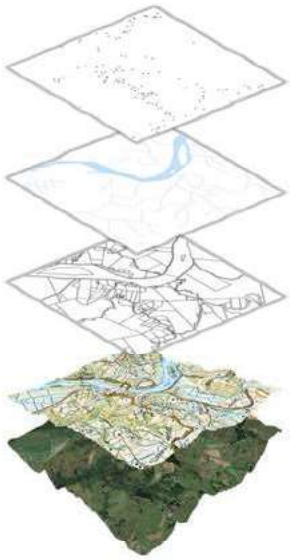
## So what is GIS?

I often describe GIS as like pizza: you'll want different flavours of maps, for different user needs, and not one with everything on it.

- You can layer anything, as long as fits within our pizza box coordinate system.
- We do spatial analysis to find the slices with the highest density or least areas of pineapple.
- Different types of pizza need different basemaps depending on what you're adding on top.
- Quality of data ingredients is usually more important than quantity.
- Metadata describes where the ingredients came from and who made it, how and why.
- We bake the pizza as best we can, with what we have, in the time available.
- You don't need to make the pizza yourself, if you know the gist of it you can ask someone else.
- The colours used are important, and the GIS pizza must be visually consumable.




**Enjoy this LiDAR rainbow colour palette and chicken shaped tree (-37.3809, 175.6764).**



## Points - Places

**Used for:** Pou poles, place names, trees, posts, sites of significance, urupa, pa, springs, cultivations, middens, any pin or latitude longitude type location.

## Lines - Paths

**Used for:** Awa, tracks, paths, roads, fences, ridges, tree lines, boundaries

## Polygons - Areas

**Used for:** Areas of interest, rohe, blocks, boundaries, rahui, buildings, urupa, cultivations.

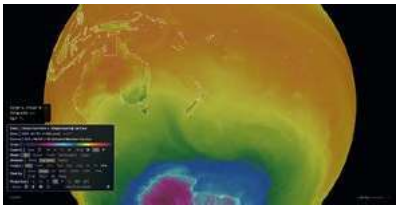
## Raster - Imagery

**Used to represent:** Topographical maps, satellite images and aerial photography, historical scanned survey plans, 3D elevation surfaces, processed LiDAR elevation, depth and bathymetry.

**An example of the layering concept used in GIS.**

Learning GIS can be overwhelming and difficult for those starting out. GIS practitioners are focused on the collection, analysis and maintenance of data which can be time consuming, frustrating and expensive. GIS software focuses on operations, and processes, and is a constantly developing area as all aspects expand exponentially.

Geographic information systems are a collection of tools that work with spatial data or location based services. GIS traditionally is used to capture, store, manage, analyse and visualise spatial data in a software environment. Developments in remote sensing, artificial intelligence and research are changing the breadth and definition of what a GIS is. As ever more satellites stream live data back to earth, remotely sensed data and imagery are now managed using cloud storage systems and automated geospatial processes.



**Try out this fascinating online weather app from *earth.nullschool.net*, which provides dozens of different live feeds inferred from near real-time satellite measurements. *hae.re/earth*.**

## Where can I get a slice of this pizza?

There are a few options to just dive in and get started – here are four that I'd recommend:

1. **Google Earth:** Download and install Google Earth Pro for your desktop from *google.com/earth/versions/* and say goodbye to the rest of your evening as you fly from place to place, you must of course zoom to your own home first, this is obligatory!
2. **ArcGIS Online:** Sign up for a free ArcGIS Online account, and begin learning about StoryMaps from *storymaps.arcgis.com*, browse the gallery and then start making your own.
3. **QGIS:** When you're ready for a deep dive, download and install the free QGIS desktop from *QGIS.org*, then head to YouTube for thousands of tutorials.
4. ***Kobotoolbox.org*** is an option to start creating your own forms for offline field data capture, and is a useful free alternative to get started if your organisation doesn't have access to Survey123.

You'll be able to find a heap of ready-to-use data available in a variety of formats – like the LINZ data service – from many government agencies to use with these apps: *data.linz.govt.nz*.



***Earth.google.com* 3D is great fun: start there.**

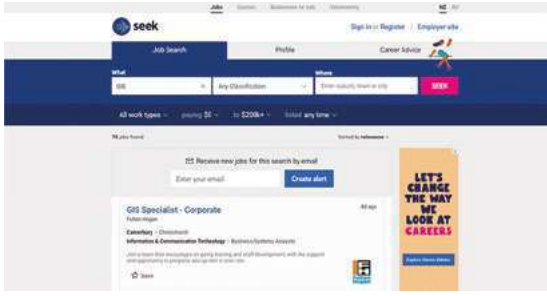
If you've never used any mapping software before, and are not technically confident, a gentler and often satisfying approach to mapping can be found in *mymaps.google.com*; here is an example map I created: *hae.re/huntly*.



**A made-up example map on a wetland just north of Huntly.**

## But are there jobs in GIS?

At the time of writing in February 2021, there are 75 GIS-specific jobs advertised across New Zealand at *seek.co.nz/GIS-jobs* – this dipped to 54 in mid-2020 during the pandemic.




***Seek.co.nz*, *Trademe.co.nz*, and *Jobs.govt.nz* are useful sites for exploring GIS jobs.**

As in many fields, many roles are not advertised and instead recruited through networks connections and colleagues.

Having a basic understanding of GIS tools, processes and data in your CV can help you stand out in a tsunami of resumes for a manager desperate for staff. It indicates you have developed useful technical skills, or for some it is interpreted: this person is skilled in the dark arts of mapping sorcery.

If you are thinking about moving into a GIS-focused role, you will want to make a moderate investment including some tertiary study beyond the basics of software including cartography, geo-processing, data management and creating online GIS web applications.

## What should I focus my learning on?

Start small, and simple – there are videos and short online tutorials, which will help feel like you're making progress. Or go all in, and sign up for an online tutor-led course; whatever works for you is the right choice.

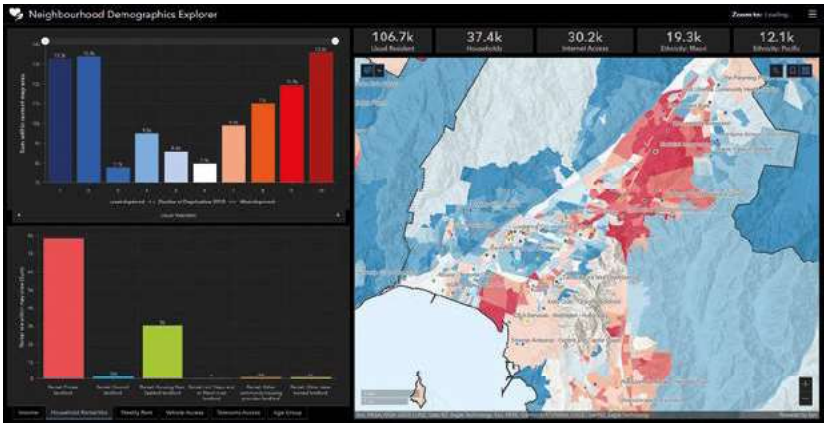
My path started when I was about 25 years old, after visiting a university display one Saturday at the Mystery Creek agricultural fieldays. In short order, I left my 'promising' fast-track career in low-wage retail garden centre management (which I didn't enjoy), moved house the next Friday, and started a remedial study course at the University of Waikato the following Monday. I didn't have a mortgage though.

To be successful in applied GIS, after learning a lot of this the hard way, here are my suggestions:

1. **Communication:** We are data geeks, and maps are a powerful communication tool, but we often have difficulty describing the value of GIS, and presenting it in an engaging manner. Start now by exploring *StoryMaps.ArcGIS.com* as an alternative tool to PowerPoint. Watch a few of the most popular TED talks to understand great communication and avoid bulletpoint presentation design. We may never quite get there, but an aspirational journey is important. Top 20 Ted talks: *hae.re/ted*.
2. **User needs:** People will often ask for what they think they can get, and they may not quite understand what they really need. For example, they might ask for a map, but may really need a form to fill in on their smartphone and a dashboard summary of results. By asking a few open-ended questions and exploring what they're doing, you can often provide an online tool for much less time than creating a printed cartographically splendid map.
3. **Project management:** I will often ask in training workshops: "How long does it take to cook an egg?" It's a trick question, and the answer is not three minutes. "It depends" is always the correct answer. Depends on what, where, when, how and importantly why you are asking me to cook you eggs now in the middle of this workshop? (The answer is usually more like hours). Quadrupling the initial estimate of time is normal in GIS tasks as it "depends" on the data being "just so", when it seldom ever is.

   The best answer I had to this cooking eggs question was: "How about you just have this Moro bar instead?" Finally, a user-needs interpretation that hit the jackpot!
4. **Real-world applications:** Most online tutorials will use US or non-New Zealand datasets. It's extremely important to discover what data exists and also does not exist for Aotearoa. Explore the services from LINZ, MfE, Stats NZ, and Manaaki Whenua available on *data.govt.nz*.
5. **The technical stuff:** It is still important to know the basics of using desktop GIS, finding data, geo-processing and working with tables and making a map for printing. QGIS and ArcGIS Pro are desktop tools that do this. At the moment though, 95 per cent of my work has focused on using and teaching online tools as they don't require any infrastructure or software installation.

   Often GIS involves creating data collection forms and maps tailored for smartphones,




**An interactive 2018 census demographics explorer created for the Covid-19 response. *hae.re/demo*.**

interactive StoryMaps, 3D visualisations, and summary dashboards for decision makers, all of which are online focused. During Covid-19 restrictions, I spent four months working from home on the operational response almost entirely in Google Chrome, but desktop geo-processing still has its place in analysis and business as usual data management.

## Let's start with good, fast, easy and cheap

### *Online courses*

Get started with a gentle overall introduction now with this free online introduction to GIS from the University of California, Davis and a certificate of completion: *hae.re/gis-awesome*.

Penn State University also has a range of free open courses available. Who wouldn't want to learn GIS from Professor Handwerk? *hae.re/handwerk*. Check out this introduction video, and browse the courses available: *open.ems.psu.edu/courses*.

There are a vast number of free online courses available from universities and enthusiasts, and Google will be more than willing to help you find them, try using the keyword 'MOOC' or massive open online courses.

### *Online webinars*

#### GEOBITES

Toitu te Whenua (Land Information NZ) is currently running a series of GeoBite webinars for NZ GIS practitioners, exploring a range of topics specific to New Zealand geospatial workflows, data and explanations from a variety of NZ GIS experts. *hae.re/geobites*.

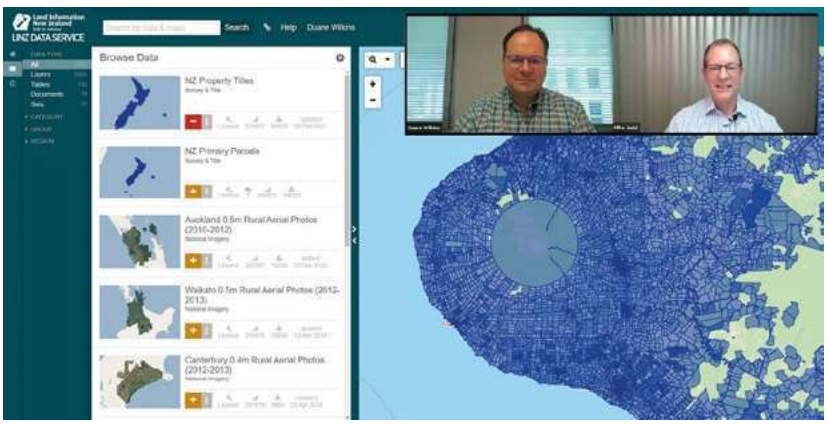
#### BROWN BAG RESILIENCE SERIES

This is a series of short webinar presentations by subject matter experts for those interested in improving the resilience of New Zealand and New Zealanders. Although they are not always strictly GIS focused, they are more often than not. These are hosted by Land Information New Zealand and the Ministry of Transport. *hae.re/bbrs*.

#### NGĀ POUTAMA MATAWHENUA

For those with iwi and Māori interests, throughout 2021, we're also running the Nga Poutama Matawhenua – Practical Māori GIS Mapping Wānanga, *linz.govt.nz/poutama*, a programme of fortnightly online mapping wānanga in collaboration with Te Kahui Manu Hokai – the Māori GIS Association to help learn how to map the whenua and tell stories through GIS mapping.

These interactive wānanga are specifically tailored towards those working for iwi, Māori trusts and environmental groups and could be useful to those wanting to learn more about applied GIS workflows and tools for land management, environmental monitoring and storytelling.




**GeoBites: Practical demonstrations for GIS users.**

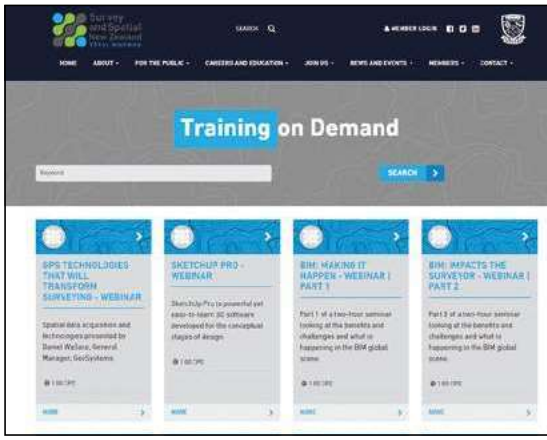



**One of the StoryMap-based resources used to share data sources for Māori GIS Projects: *hae.re/md*.**

#### LINKONLINE SEMINAR SERIES

Manaaki Whenua – Landcare Research Link is a series of short seminars and discussions for environmental policy-makers. These sessions provide an informal way for scientists to deliver key research outcomes or share the science challenges with a broad-based policy audience.

Themes to date have included a range of ecosystems services topics, the aspiration for a pest/predator free New Zealand, modelling of economic impacts of land use policy, freshwater management, Māori land, biodiversity, soil mapping and policy innovation. *hae.re/link*.




**Training on demand available from the Survey and Spatial New Zealand website.**

#### SURVEY AND SPATIAL NEW ZEALAND

also regularly organises webinars with a focus on geospatial, surveying and data use. These are made available on demand for a fee, and

include a range of themes including positioning, aerial survey and imagery, datums and projections, climate change, and even conference presentations. *hae.re/ssnz*.

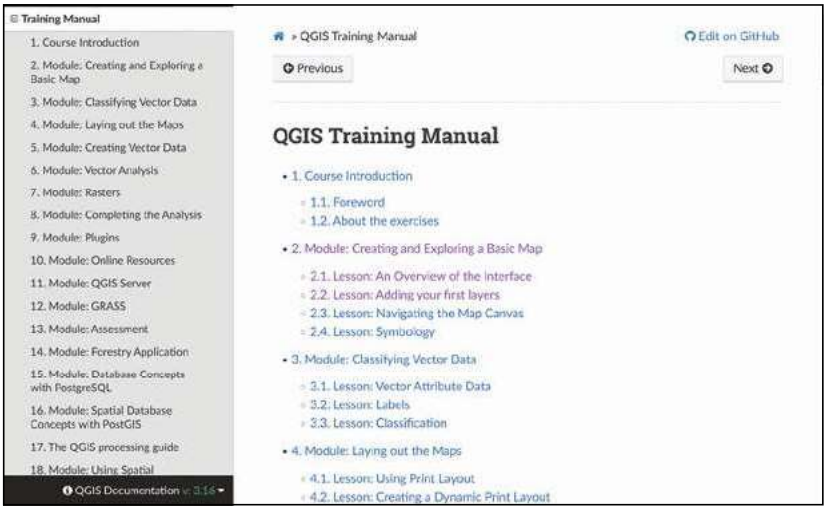
### *Self-directed step-by-step short courses*

If you prefer a more structured and detailed approach, there are a good range of free online courses available that also provide certificates of completion.

**Esri ArcGIS** is a commercial software suite, the geospatial equivalent of Microsoft enterprise and office applications, including a range of mobile, desktop, online, cloud and server based applications.

There are currently 355 free online courses available, ranging from a couple of hours to several hours learning. They are arranged by learning streams, categories, workflows and applications.

You will need to sign up for an Esri 'Public' account. The simplest option is to use one of your existing Google or Facebook accounts to set up a login. If you already have access to an ArcGIS Online subscription through work, you will be able to access a wide range of additional tutorials on a wide range of software applications.

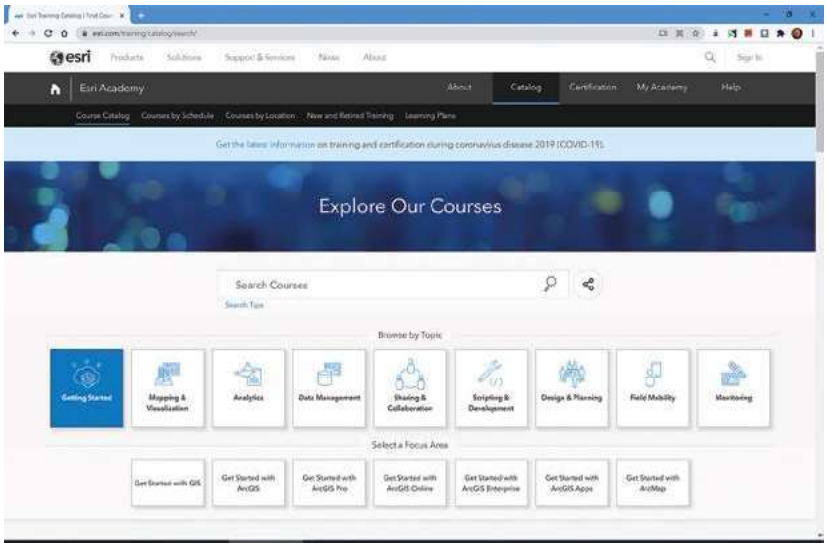



**The QGIS Training Manual from *QGIS.org* is very comprehensive and thorough.**

There are also a range of in person, virtual or hybrid instructor-led ArcGIS suite courses available from Eagle Technology that are 1-3 days focusing on workflows or a particular application. Well worth a look: *eagle.co.nz/learn*.

## At last! A desktop GIS that runs natively on MacOS and is free

QGIS desktop is a professional GIS application that is free and open source software (FOSS). QGIS runs on Linux, Unix, Mac OSX, Windows and Android and supports numerous vector, raster, and database formats and functionalities. You can download it now and there are extensive and numerous training courses, YouTube videos and an online training guide and sample data available from the QGIS.org website, or use this link to go directly to the training material: *hae.re/qgis-training*.

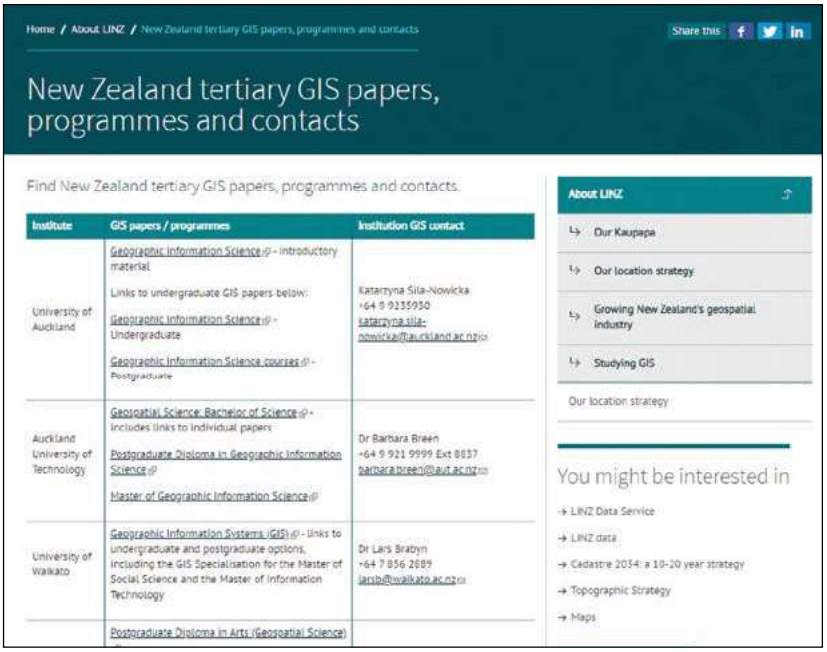



**A wide range of ArcGIS online courses are available at no cost at the online campus.**

## Low-cost online options

There are several sites offering relatively low-investment online courses, but a couple stand out. Try searching using keywords like GIS, geospatial, spatial, or remote sensing.

- **Coursera.org:** Coursera provides a wide variety of high quality courses from well-known international universities (Yale, Stanford, John Hopkins) and companies (Google, IBM, SAS) offering short courses to a range of online degrees. Coursera has a base monthly subscription of US$49 a month, with additional fees for some degree-based programmes.
- **Udemy.com:** is the largest online provider, starting from US$12.99 to US$169 for courses. There are an astounding 673 courses when searching for 'GIS'. Because anyone can sign up to create a Udemy course, the quality may not always be up there, so be sure to check the reviews before making a commitment in terms of time and finance.




**A comprehensive list of study options is available on the LINZ website: *hae.re/studygis*.**

## Go large or go home – enrolling in university paper or programme

If you prefer an in-person option (Covid-19 permitting) then enrolling at a university near you is a popular mid-career option. You'll get to meet like-minded people and be exposed to a different way of thinking.

### *Invest in yourself*

You can start with just a single paper, generally requiring a lecture and tutorial session each week for about 12 weeks, and costing about $800-$2000, which you can put on a student loan and pay off over time at low or no interest.

Most workplaces will provide support or make a contribution toward career planning and professional development, or you can discuss adding this to your annual performance agreement. Contractors and sole traders should check with your accountant first as you may be able to offset it against your taxes for certain courses.

### *Learning institutions teaching GIS in Aotearoa*

For a comprehensive table of programmes including direct links to papers, and contact details for options: *hae.re/studygis*.

### *I'd like to learn more, just tell me what to do*

Woo-hoo. Here is list of suggestions to get you started:

1. Begin your quest by embracing YouTube. Look for videos by Esri, by universities, and temper your enthusiastic approach with a healthy 'daily dose of the internet' clips. Search for GIS + keywords of interest, like flood modelling, 3D, survey, drones, environment, conservation or GIS + crime is interesting too.
2. Download and install Google Earth Pro desktop from *google.com/earth* if you've never used it before, then explore *StoryMaps.ArcGIS.com*, and then try *QGIS.org* when you're ready to take a deep dive in.
3. The next step is to complete a few free introductory GIS courses from Esri Campus or Udemy.
4. And then when you are ready, find an online or in person university paper to test the waters (before committing to a GIS-based PhD as several of my Iraqi engineering colleagues did and have now successfully completed them).

So give learning a bit of GIS a go, watch a few webinars, try a few online courses, invest in your own professional development. Your learning journey may see you visiting places you'd not expect (and next time I'll tell you about that time I did infrastructure GIS in Afghanistan and interviewed a member of Taliban for a GPS survey job). ●

