Speech to NatureServe on receiving their conservation award

Bob Jenkins, 26 April 2010

Introduction

In thinking about how to accept this award, two basic alternatives suggested themselves. One was the always popular, gracefully succinct, accepting-an-Oscar approach . Or maybe just the Elvis, "Thank you, thank you very much." Or perhaps some variant of my all-time favorite, the Milton Berle, who looked long and soulfully at his plaque, like I'm doing now, turned to his audience and with great emotion and sincerity said, "Of all the awards I've ever received, this is the most recent."

However, I've chosen the less popular long option, the Nobel laureate speech. This isn't the way it's usually done, I think, but I'm going to try to explain to you why you're giving me this award. I'll do this by recounting some of what I can remember of the history of Heritage and my part in it. Of course I could do it blind-folded but then it would be disordered and filled with Freudian slips, so I've written it down. I tried to borrow President Obama's teleprompter but he wasn't giving it up, so I hope you'll forgive me for looking down at the paper. I'll have to read fast, so pay attention. Pretend it's a bedtime story. I will get choked up 3 times in this rendition, so bear with me.

That this history is a black hole was brought home to me by a phone conversation I had awhile ago with one of you, a long-time state Heritage coordinator, in the course of which it became evident that he had no idea that I'd been the main designer of Heritage methods and systems. When I explained that I had personally designed mostly everything but the computer programs, his response was, "Oh, I thought you had a staff for that."

At the time I was thunderstruck but quickly reflected that it takes a life to lead a life and nobody really knows what anybody else does. I left a pretty extensive written record but who reads that? Besides, I hardly ever signed it. For instance, I wrote nearly the entirety of The Nature Conservancy's first long range plan, even the sections on finance, fund-raising, and land protection techniques, and the great preponderance of the second, third, and I forget how many succeeding editions, until the main outline became fixed and the details conventional wisdom. I also wrote or co-wrote nearly all of the Conservancy's operating procedures manuals, all but the Heritage manual, ironically enough – I didn't have time to both develop the technology and to document it. If something was standardized, I probably did it. Hell, I even developed the format for the Conservancy's standard job description.

If you're wondering why such things were left to me, you have to understand that when I started, the Conservancy was quite small and everyone in it was totally wrapped up with land acquisition, fund-raising and deal-making. Under the circumstances, I was obliged and enabled– it goes without saying that I was also inclined -- to think about everything else. The world of ideas, you might say, was left to me by default. Thus, much of the modern Nature Conservancy and virtually everything about Heritage first took shape on my whiteboard.

My role in the Conservancy was an interesting one, serving as a sort of pope to the organization – though my infallibility wasn't always recognized. My secular powers were limited but my spiritual powers were great. I couldn't usually order you to do anything but it was my place to show that the righteous path was to behave in a certain way. Kind of like Heritage programs after they spun off.

Conservancy up to 1970

So here's the story. In 1917 the Ecological Society of America established a special committee on the Preservation of Natural Conditions. This committee split off in 1949 to become The Nature Conservancy, but before it did, in 1924, it published a book called A Naturalists' Guide to the Americas. This was the first attempt to identify important "natural areas" for preservation.

It isn't too clear what the early Conservancy was intended to do, except to somehow protect natural areas like those the Guide had identified. It was some years before it undertook direct land acquisition, probably first at Mianus River Gorge. The organization pretty much remained a committee of scientists until the early-60s, when a board faction obtained a Ford Foundation grant to make the organization more businesslike. Many of the board scientists resigned and the organization was corporatized, mostly for the better. After awhile, however, a remaining board scientist, Dick Goodwin, obtained a grant to hire a staff scientist. That turned out to be me.

My story begins

By that summer of 1970, I had completed my PhD on co-adaptation of tropical fruit eating birds and fruit bearing plants, but was still at Harvard, finishing up a post-doc as a Demographic Fellow of the Population Council and a ZPG organizer. E. O. Wilson, one of my thesis advisors, proposed me for the TNC job before he even told me about it. I understand that I was ultimately chosen over several distinguished scientists and a university president, either because I was the only one who would accept the paltry salary or because I was seen as green and malleable. Green I was.

At that time the Conservancy staff consisted of about 40 people, mostly at the headquarters in Arlington. There was a tiny Western Regional Office in San Francisco and two or three people working at scattered locations, notably John Humke in Illinois. Three more one-person regional offices were just being established. The president, Tom Richards, was a businessman and politician, and the VP, Ed Kingman, had been a former comptroller of the Navy. Pat Noonan had been hired as assistant director of operations six months earlier and directors of development and finance were hired a few months after I came aboard. Up to then, the organization had, in my view, made five significant inventions -- land acquisition itself; state membership chapters; local project committees; a project-revolving-fund, and cooperative acquisition with government agencies.

No one was sure what to do with me. Tom Richards said he wanted me "to improve the quality of TNC projects." However, he also told me that his philosophy was to "grab anything, they ain't makin' any more," so I was a little mystified about what "quality" he was referring to.

I begin work

I knew immediately that Richard's idea about grabbing anything was wrong. As long as you are stuck in a growing society, I reasoned, withdrawing a piece of land from the stream of development doesn't prevent the destruction that might have occurred there; it only deflects it onto other lands. Moreover, whatever you're trying to save, there must be a priority sequence among land areas, say 5% being most important. Random withdrawals, therefore, have a 95% chance of falling elsewhere on the importance spectrum. Thus I reckoned, whatever it was that TNC was trying to save, the organization was increasing its peril instead. Unplanned development and unplanned conservation go hand in hand.

Before I'd reached any further conclusions, I talked to the guy who had just resigned from the job of corporate counsel and wasn't shy about expressing his low opinion of the organization. Wishing to think well of my new calling, I said to him, "But still, they must be doing a lot of good." "Maybe," he growled, "but if so, it's an accident." Although I think he misplaced the blame, I gradually realized that he was exactly correct. Given that the process for selecting projects was somewhere between faulty and non-existent, and that none of the lands being acquired were actually designed for viability and defensibility nor completed in any ecological sense, I realized we had no idea at all about what we were doing.

So I began to think about what we should be trying to protect. We had proponents for everything from scenic landscapes to urban parks to hunting and fishing reserves to recreational open space, and even for throwing in historic preservation. The most prevalent idea was that natural areas were those that showed the fewest signs of human disturbance with some concept of an ecological climax as the dominant search image. Insofar as TNC was choosing projects other than opportunistically they were repeatedly saving examples of whichever ecosystem types were least disturbed, or most regenerated, while ignoring damaged remnants of the ecosystems that had been most impacted. Ergo, the organization was disparaged in the northeast as the "gully and hemlock society "and in the midwest as the "prairie cemetery lovers."

My family and I drove out to see the local preserves – when we could find them – and I began trying to compile information on existing TNC projects, something that hadn't been done. I discovered that the "grab anything" idea had been in full force, encountering several projects with no redeeming qualities that had been done just to show how land acquisition worked. Parenthetically, I later conceived what became the tradelands program as a way putting such low-quality real estate to better use. Pat Noonan and Ray Culter later brought it to fruition. As projects were undertaken, so-called "project packages" were circulated to all department heads for review and approval. I had no yardsticks to measure the significance of any of them. Once, someone circulated a proposal to acquire a so-called Agassiz Glacier in the upper Midwest with the value of the project portrayed in terms of the price of ice-cubes by the bag. I had become so inured to absurdities by then that I almost didn't get the joke.

I learned most of the above during my first month or two at TNC. At that point I rejected the ideas of saving prettiness, open space, and the like and decided that, in the abstract, there were two worthy objectives for natural land conservation. You could either seek to preserve ecological function, which I called carrying capacity, or you could try to preserve the full array of biological and ecological entities,

which I called natural diversity. To have a meaningful impact on the first, I thought, would take an enormous effort, beyond the reach of a tiny conservation organization. Therefore it seemed to me that TNC should seek to provide ecological lifeboats to save biological species and communities from extinction.

Thus my first contribution to the Conservancy was to invent what we now call biodiversity conservation. Of course the details all remained to be worked out, and biodiversity had been a topic of academic research since Darwin, but I yield the palm to no one in a conservation context. Within a year or three the logic and clarity of the argument persuaded the Conservancy to adopt the "preservation of natural diversity" as its mission, the first institution on Earth to do so. Initially we so completely owned the concept that when the word got around; we were approached by a then much larger conservation organization to ask whether, if they too adopted the natural diversity objective, we would regard it as an invasion of our turf. We gave them our permission. Not long after, at a meeting to review a draft of the IUCN world conservation strategy, I criticized it as a formless mishmash and offered up my original diversity/carrying capacity dichotomy as an organizing principle. When the final plan was published six months later that's just how it had been reordered. The biodiversity conservation idea continued to catch fire.

The idea of preserving diversity isn't the only view of the world, I know. Once, during an outside review of the TNC science programs, one of the reviewers argued that we had it exactly wrong, that we should be concentrating on common species, not rare ones, because the dominants are of greater ecological importance – like he could know this. And a few years before that a famous ecologist then on the Conservancy board -- OK, it was Gene Odum -- opined that we should drop everything and devote ourselves to green-belting the sunbelt cities. I could mention that we had another board member, Johnny Hanes, who strongly urged us to drop our science program altogether – stick to action and leave the thinking to the Isaac Walton League. At least the first two had a cogent thought, apparently to use ecology for further re-engineering the planet, we having done such a great job so far, instead of to saving and understanding it as it is. But to a guy who gave his 8th grade valedictory address on the looming threat of species extinctions – that would be me – saving diversity made and still makes the most sense.

Undertaking inventories to identify land conservation priorities

We'd established the objective of saving biodiversity but we still had no systematic process and lacked any kind of knowledge base from which to begin. I started by trying to get a handle on published and ongoing natural area inventory efforts. In the second long range plan, I included a list of these -- as potential guides to project identification. It was all I could do at the time.

I'd like to digress here to tell about one consequence of doing that. I actually had three eureka moments in my years at the Conservancy and the first of these came from an interaction with the western regional staff over that section of the long range plan. That particular flash eventually led to the establishment of the Conservancy's state field offices, the main engine of its later rapid growth and prosperity. However, that story would take me away from this Heritage narrative. My third such

moment was about a way to undertake conservation internationally that was never implemented. The second I'll get to shortly.

I soon began getting directly involved in inventories myself, most importantly with the IBP Conservation of Ecosystems program. The International Biological Program was a big research initiative launched by the like of ICSU and various academies of science. It mostly focused intensive ecological research on specific biomes -- deciduous forest, conifer forest, grasslands -- but someone had thrown in a conservation inventory component and by the time I came on a U.S. project to essentially update the Naturalists' Guide was just getting underway . I became its most active committee member.

The natural area inventory process

The inventory concept hadn't advanced beyond the Guide's original idea of consulting the "experts" – biology professors mainly -- about where they thought the important "natural areas" were and why they were important. Nothing directly related to the biodiversity objective but maybe a useful step along the way. Someone in England had developed a 7-page "checksheet" of information about a given natural area -- its location, extent, contents, and perceived importance. We had a limited mailing budget so I worked with Paul Lemon, a retired grassland ecologist and the only staff, to compress the checksheet. We developed a mailing list based on my source compendium and sent it out. Anticipating a lot of what we deludedly called data coming in, I set myself the particular task of finding a way to computerize it.

My experience with computers was very limited so I was lucky to find Jim Mello, in charge of a new Honeywell mainframe at the Smithsonian. That big machine had less power than a modern cell phone but was the hot lick back then. Input was by paper-tape typewriter, which I thought was a miracle. I further boiled down the checksheet to its barest essentials – the system limit was a handful of data fields each limited to something like 240 characters -- the final data form would fit on a 3 x 5 card. Jim programmed it, and this became the first of 6 generations of computer database systems I would eventually design. We began digesting the published natural area surveys, Paul badgered the experts, and questionnaires trickled in. We had just enough funding for a part-time typist to get it on the computer. As you can probably guess, the entire project wound up being a nearly complete waste of time and effort – except perhaps for educating me.

This might be an opportune time to tell you what I think of myself, in case you were wondering. I'm pretty smart –high IQ, intuitive, and a strong independent thinker with a lot of ideas, but my gears often grind slowly and I've never considered myself a creative genius, no Isaac Newton certainly. Instead, I'm something of a Bill Gates without the money, a reasonably intelligent person who chose a somewhat unusual career path, had a few lucky insights, and then just kept plugging away, periodically coming up with something new. The new stuff may not always have been the best conceivable but it was always an addition to an incrementally growing body of knowledge, technology, and information.

Gifford Pinchot famously said that "the most powerful thing in human affairs is continuity of purpose." Probably everybody that ever did a natural area survey learned from it, but then they had to go back to

their real jobs. There was no such thing as conservation biology and nobody taught a course in natural area inventory. I may have been the first person in the world to be paid a full-time salary to think about this stuff 24/7, year after year, and thus the first person in the field enabled to learn from his mistakes.

State Heritage programs start

About 1973, Jimmy Carter launched a program called the Georgia Heritage Trust to protect places of natural and cultural significance. It had an inventory associated with it, partly consisting of a team that drove the roads to see what would jump out. I had nothing to do with it. However, Rick Jones, our southeastern regional director, was able to acquire about $12 million worth of land for the State at less than 50 cents on the dollar. This impressed Carter enough to urge his surrounding governors to cooperate with TNC on similar endeavors. Consequently, John C. West of South Carolina set up a similar program and sent Andy Laurent from his Wildlife and Marine Resources department to request our assistance on an inventory, surprising since we hadn't done any of that in GA.

I didn't want to do it. My department consisted of just me, plus Ray Culter working on stewardship, Brian Bedford working on ecosystem restoration, and maybe a couple of others. I needed to provide guidance to the entire Conservancy, not just a single state, but Pat Noonan, the government coop king, thought working with government was a good idea, so I agreed to try it.

Every Heritage program has been a saga with its own cast of characters and surprises. I could have focused here on that, but I expect you live with such stuff every day. In SC they had in mind a two year inventory. Data management was to be handled by a computer system just starting up for natural resources. The surprise came about two months later when I got a call from Andy, asking what progress I was making on my computer system. Not to make an issue, I said I was getting right on it.

I scraped up some money to hire our first programmer, Helmut Moyseenko, and reworked the IBP form, quite a bit larger than the earlier Honeywell version. We found a local service bureau with an IBM 360 like SC's, and Helmut started programming our second generation system.

On the inventory side, I still hadn't learned that much, my main idea still being to ask the experts and go on from there. I knew so little that when I brought in Tom Kohlsaat, our first-ever Heritage coordinator, for a week of training, I was starting to repeat myself by the end of the second day. During a pause, Tom looked over at me and said, "That's it, isn't it?" I sheepishly agreed that it was and he took an earlier flight to South Carolina.

Aside from inventory methods though, I had learned a few other useful things. I'd found that our work with state government was eligible for matching funds from the Federal Land and

Water Conservation Fund, under the unlikely but workable rubric of outdoor recreation planning. Hardy Wieting says that the LWCF revelation was his eureka moment, when he realized that this just might be a climbable hill. State-side funding could come from public or private sources and I'd also tripped to the fact that matching money is magic in funding circles – multiplier effect and all that. Moreover, I'd come to a useful generalization that probably still holds true today -- that a "project" of any sort generally falls within a narrow budgetary range. In those days $100,000 constituted a sort of standard big project – that's what we had from NSF for the IBP and that was the amount for SC Heritage. Much less wasn't taken seriously, much more was hard to get. Today it's probably a million. The scope of a project didn't make much difference. The mundane fact was that if we'd undertaken an inventory of the whole world we'd have found somebody to cough up $100,000 for it, but by working on a state-by-state basis we could potentially get start-up funding of around $5 million – that is, $100,000 times 50 -- not counting matching money. Stupid but true. Also, I began to like the idea of working with state government agencies because I'd decided that inventories need to be ongoing, and government is as good at maintaining bureaucracies as I knew the private sector wouldn't be.

Eureka

Armed with this knowledge, we got rolling. New programs started up quickly in MS, OR, TN, and WV. Through an odd twist, the one in WV led to the most transformative breakthrough in Heritage history – my second eureka moment.

This breakthrough came about because of the nature of the still-primitive computer systems. If a given natural area record listed a Bald Eagle nest as an importance factor, the logical next question was, "So what?" Well, we really didn't know anything about bald eagles, just the conventional belief that they were rare, apparently declining, and needed help. All we could additionally learn from our natural area records was whether anyone had thought to assert that they existed on any of the other areas in our system. Unfortunately, that data was stored on tape and submitting a query to search for other alleged Bald Eagles would trigger a sequential read of the whole thing. Processing for this cost roughly $25, a significant amount of money from a 2-year, $100,000 budget (again, that number), and we would have wanted to run such queries all day long.

Our West Virginia coordinator, Frank Pelurie, complained bitterly that using our system would quickly break his budget. Stewing over this problem, I had a sudden thought, "I know," I said, "we'll invert the files." My initial inspiration was just that by organizing our information differently, we could get away with reading only part of the tape and thus save money. In the very next moment though, it was as if the scales had fallen from my eyes. In a single instant I

saw the total stupidity and futility of the approach we had been taking – that I, and everyone else, had always had everything upside down.

Within half an hour of this revelation I had defined and named the Element, the Element Occurrence, the Site, the Tract, and the Managed Area records -- still the backbone of Heritage inventory methodology to this day. I soon began calling my resulting diagram the data salamander from the way I always drew it wiggling across the page – it wiggled across my whiteboard for many years. Within a few days I had created first drafts of the formats for these record types, had added the Source (of Information) Abstract, and had Helmut beginning to program our third generation of data management systems.

Of course vast complexities lay ahead; more on that in a minute, but now in one stroke our entire business was transformed. We were going to be gathering actual data, from any source, about Bald Eagles themselves, and the rest of what I immediately called the Elements of Natural Diversity – and about their localities or Occurrences. From this accumulating information we would decide which Sites were significant targets for conservation. Before, we had always been asking people to identify the significant natural areas as the starting point, using some vague and indefinable instinct. As our data accumulated we gradually discovered that from a biodiversity perspective the instincts of the experts had always been terribly incomplete, and aside from the occasional Savage Gulf or Pascagoula Hardwoods, very frequently just plain wrong.

But enough said – you do this every day, I hope, and you're thinking, "Of course, how else would you do it?" But no one had ever looked at it this way before and at my moment of insight I thought I would burst with it. And I guarantee you, without that single eureka moment, the whole Heritage undertaking would have died a well-deserved natural death and you wouldn't be here having this conference.

I'd been thinking for years about all kinds of things that now came together. For instance, my "coarse filter – fine filter" approach was inherent in that first eureka moment -- community types as the coarse filter, rare species as the fine filter. Do you still speak of it that way? My thinking was that if you came up with a classification of recognizable community types for a state, and then found good Occurrences of each, collectively they would capture a large proportion of all of the biological and geophysical diversity of the state – say 80%. To do better, you might subdivide the community types by making finer distinctions, say into twice as many, and their Occurrences would likely increase the statistical capture of everything else --maybe to 85%. But diminishing returns would already have set in, so I thought that an efficient way to capture the remainder was to jump to the other end of the abundance spectrum, focusing on Occurrences of the rarest species (or subspecies, or even populations). These, because of their rarity, probably because they occupy narrow ecological niches, are most likely to fall through

the coarse community filter. Moreover, I reasoned, since many such species are probably micro-habitat specialists, they are likely to co-occupy areas with other unknown or un-inventoried species that are thereby captured as well, along with the peculiar physical, edaphic, or other abiotic landscape features found there. There are a host of specifics about the evolution of these ideas, but no time for them here – besides, I hope you've gone well beyond. I still believe the coarse filter -- fine filter approach was the best and most efficient for conservation inventory and planning, although we eventually augmented it with many other techniques.

A word about community classficiation. I sweated blood over this, as have many others, partly because we all know that communities are not entities like biological species with coherent genomes, isolating mechanisms, etc., and the underlying fluidity is a constant cause of dissatisfaction. Aquatic and marine systems are the worst. If this troubles you as much as it always did me, you must set aside the idea of community classification for its own sake and console yourself, as I did, with the realization that as a coarse filter for conservation inventory, nearly any reasonable classification of discernibly different communities can work. You can continue to wrestle with classification forever, but in the meantime, inventory and conservation planning can go on.

This approach shows that the Heritage process is an attempt to model reality. Because of limited resources, it has to be an efficient model. I often recall a remark that Tom Kohlsaat, with his pithy dry wit, made about that SC natural resource computer system – you remember, the one that was supposed to have managed our Heritage data for us. A year or two later, we asked what was happening with it and he said he had low expectations, because in his view, that program, which had by then become an early GIS, was attempting to "create a roadmap of the state at a scale of one to one." This is something that no one will ever be able to do, and wrong-headed on its face.

The coarse filter- fine filter business is just one of many efficiencies in Heritage methodology that contribute to the success of the enterprise. That one operates effectively at the level of the individual program but there are lots of others that result from the network of many programs using standardized methods. Each individual program contributes some partial support – I hope -- to a central system group that is thereby able to develop vastly better and more sophisticated technologies than any individual program could afford on its own. The individual programs, in turn, collectively focus more critical thought on the shared methodology and generate ideas for enhancements. The subsequently enhanced system can then better serve not just the program that produced the given idea but all the others it hadn't occurred to yet. And, with shared continuity of purpose, the system can just go on getting better and better

Standardization extends to well-defined common terminology that allows for reliable and efficient communication. This enabled us to amass data upward and redistribute it downward. I compared notes with Keith Carr and Larry Master on what we all agree was a vital step -- our creation of the central databases. The original central databases were created to provide a taxonomic standard to relate all the rare species being tracked by local inventories – it would have drained vital resources from every program if they had to try to do this for themselves and the results would have been non-uniform, complicating efforts to share data. We started with pretty well-refined taxonomies for all vertebrates and vascular plants – thanks to John Kartesz for the latter -- and gradually added many invertebrate groups and nonvascular plants. We also made attempts to track the community Elements where they overlap state boundaries, still not very successfully by the time I left – I hope you've done better. Range-wide element planning was what I was pushing just before I stumbled.

Of course the individual programs focused on their rarest species but because everything is rare somewhere, after awhile nearly every species was receiving some attention. We can make a conservation case for the value of this, in terms of evolution and differentiation occurring in isolated and peripheral populations. Regardless of that, from a network point of view this enabled us to break up the task of compiling element data among the many programs, everyone benefitting as the system expanded into Element Characterization Abstracts and beyond. We set up elaborate data exchange mechanisms to make this all possible.

I wonder how often you reflect on the power of all of this? It wasn't something that came to me all it once, it was more of a dawning awareness of how different this was from how most people work. I'm out of touch with NatureServe and network operations these days but your main stock in trade must be the fact that all that continuity and networking makes it possible for you to answer questions that others can scarcely even frame. One thing that always frustrated me was the vast amount of resources wasted on start-ups and failures in our field, sometimes ongoing failures – by our competitors and even our cooperators--so many times greater than the amounts we were able to put to good use. This results partly from shear willfulness, but otherwise from the failure to understand this network model, continuity, the whole thing. I used to draw a complexity matrix to illustrate the point – I think I may have gotten it from John Gall's wonderful little book, Systemantics. It shows databases on one axis and numbers of users on the other. It starts with a single flat file in one corner with a single user. Users increase on the one axis, database complexity on the other – the combination of the two compounds geometrically. The big complex data system employed by many users stage is hardly ever arrived at but the beguiling nature of that first flat file is the cause of so much waste. I once had several USDA summer interns conduct a survey to find out what the department was doing with information and systems that might be useful. I started them off with four not very good but related programs I knew about and they spent a month finding out about over 200 others – this is not a joke -- that had been started and were still thought by someone to exist. They

spent two more months finding out that every one of them had disappeared without a trace. Does this make USDA unusual? I'm afraid the answer is, no, not at all.

This brings me around to a couple personal points. Because Heritage is an attempt to model reality, I'm not convinced that I ever invented anything. Instead, everything always felt more like an act of discovery. Modeling reality forces you into narrow range of possibilities, among which you can only choose. I've always said that this amounts to a constant seeking after truth, but wiser people than me have often thought as much. Confucius taught that the beginning of wisdom was to call things by their right names, and Ghandi said, "I once thought god was truth and now I think truth is god" -- hence India's great national motto, "Truth alone triumphs." I think this modeling the truth business forced me to become a perfectionist. The junk-yards of the world are filled with cars that were still 95% functional – for something to really work you have to get it almost exactly right. And the best approach to perfection, I believe, is incremental successive approximation -- the Heritage concept in a nutshell.

It all continues

Back to the story. After the file restructuring event, things moved into high gear with everything happening at once. We sold new programs, several every year. We developed new methods on a nearly daily basis. We raised money on a scale not previously imagined. We built staff like nobody's business. We became the number one employer of Yale Forestry grads for a decade. We started some programs in Canada and Latin America. System advances developed apace. They were exciting years.

I mentioned before that I'd have more to say on the "vast complexities" with which we had to struggle. I remember at the very beginning tussling with the basic problem of how to identify the individual records using some kind of code – Element coding was the hardest and we went through many iterative steps to get to a workable place. I wonder what you do with this today. How to link the various geographic entites – remember, this was years before workable GIS. We called ourselves a GIS without a GIS and our linkages were via EO point centra, counties of occurrence, and the like. How to deal with boundaries in the computer – we could and did draw these on manual maps or photos, but in the computer? What to do about mapping anyway? We'd quickly settled on the USGS quads as our main referents and without them I don't know what we would have done, but we couldn't just scribble and erase on them, we'd have worn them out, so there were other maps kept in other files, along with aerial photos, lots of additional information, etc. I can remember calling down to the Mississippi Heritage program with a question about a particular thing or place, years after we'd transferred it to the State, and talking to a young person who'd never even heard of me – like any number of you, no doubt – and I didn't bother trying to tell him. But at one point, he said, "Let me look in the

Geographic Manual File," a thing I had conceived and structured a long time before. You can't imagine the joy that welled up in me. "Damn," I thought to myself, "this standardization thing might just be working out." And he found the answer to my question – something that wouldn't have been remotely possible without all those years of work, and systems, and standards, and protocols, and codes, and on and on. And there was no one in the world outside Heritage that could have answered that question. God, when I think of how benighted it has been for The Nature Conservancy to let this linkage erode I can scarcely believe it, or stand it either. Conservation by design, indeed. Whether they admit it or not, even that is totally dependent on Heritage. But that's a whole other can of worms.

I can still recall all the work I put in designing those Geographic Manual Files in the first place. What the scope of a file should be and just what to put in it. What geographic hierarchy to use and how to file nested information, and what protocols to use to cross-reference overlapping materials. I cycled back to this again and again, making improvements, none of them perfect. And outside of filing the information, how to decide from Element and EO data and other factors (and what other factors, by the way?), just when a geographic location became important enough to be designated as a Site for conservation attention and a Site file officially begun. And then how to decide what all to encompass in it, and how to think about the requirements for viability and from this how extensive it needed to be and where to set up defensible boundaries. And then what notation to use to distinguish those boundaries from other kinds of boundaries, and how to deal with changing those boundaries as thinking evolved, and on which maps to record these and in what filing structures, and how to retrieve this information and how to document and keep track of it and how amend the maps as things progresses and – but you get the idea, it just went on and on. One thing I recall as both frustrating and gratifying was that stuff we'd worn ourselves out over in one computer generation was taken care of automatically in the next, so that earlier technology, however functional and painfully developed, repeatedly became obsolete. Not the fundamental data model, though, that has endured throughout. And if it has been neglected, even with GIS, I bet I could still make a case for the Geographic Manual File. I could write a book about all of this – well, I guess the Heritage programs and methods are the book.

For 23 years I spent every moment that wasn't taken up by other duties pondering these kinds of questions. It all had to be brought together somewhere and that was inside my head. There was almost no aspect of the methodology and systems that I didn't know as well or better than anyone. And, uniquely, I also had the authority to decide. No endless debate among the equally-empowered – when I couldn't persuade I just decided. This is my history with Heritage condensed.

Note that a good way back I began to substitute **we** for I in this account, because by the late-70s I wasn't alone any more, I had assembled a smart and dedicated staff and things became much more collaborative, though I remained the chief synthesist and broke all the ties. In preparing this speech I've compared notes with a number of people and among the later developments, some of the things I thought were mine one or another thinks might just have been theirs instead. I know I never saw a good idea but what I shamelessly plagiarized it. Good ideas are to use, right? Ben Brown claims it usually took three sessions to get me to agree to anything – first I would denounce it, second I would think about it, and finally I'd say give it a try. In any case, from there on it was incrementalism on a grand scale and I won't be able to remember or report on all the steps – as if there were time. The mainframe era was passing and the available software, a word just coming into vogue, was terribly inadequate. Helmut Moyseenko had left, lost to disability from a congenital heart defect. We shopped mini-computers, just coming on, and settled on the Hewlett Packard 3000. We hired Ken Wright to begin reprogramming the evolving data salamander. The fourth generation gradually came into existence, bigger, faster, and more usable. I remember our first hard disk storage devices. They were as big as refrigerators, required air conditioning, cost something like $25,000 apiece, and had a capacity measured in megabytes – 25,000 and 50,000 stick in my mind. Random access memory was a revelation to us after the era of tape storage.

Within just a couple more years, when we decided to see what we could do with the new personal computers, we found Dave Mehlman to begin experimenting with what eventually became our fifth generation, this time on PCs in dBase. Rob Solomon came aboard somewhere along there also, maybe as the data manager for the model program – we always had one of the newer Heritage programs that we designated as the current model, to which we allocated additional resources for experimentation and testing – but Rob's still with you, ask him what he did. Later on, because of his abilities and prior experience, he took the lead on all of our GIS efforts. We decided we needed a computer czar to hold it together and I hired Keith Carr, the luckiest hire of my life. He took care of the main thing I couldn't do, the computer side -- all in-house, by the way -- and became my co-designer, he on computers, I on methods and content.

I talked to Keith recently and he emphasized to me what a great place he thought it was to work, perhaps a lot like the old Xerox research center in Palo Alto. My office door was always open, as was his. People freely talked over anything and everything in their offices or in the halls. There was little sense of hierarchy or who worked for whom. I was no martinet and paid no attention to when people arrived for work or when they left or where they worked or what they were doing at any hour of whatever day or night – consequently everybody worked longer and harder, albeit in a flexible way, than anything their employment contracts called for. Absolutely anyone could identify a problem or offer up an idea at any time and join the colloquy.

I had a big office with a white board and a flip chart that I called the "palimpsest." We had scheduled or impromptu meetings there several times a week – or sometimes every day -- to hammer away at whatever the next thing was. We scribbled on the whiteboard and amended diagrams on the palimpsest until we had worn out a page, then started another. Keith and I were omnipresent but Bob Chipley, Larry Morse, Hardy Wieting, Rob Solomon and the other computer people, Loring Schwarz, Adrianne Burk, and various others constituted a rotating group of regular attendees – it was a kaleidoscope, with its composition changing with time and topic. These discussions went on and on and the others joked that the only reason I was in charge was because my eyes always glazed over last.

We gradually began calling this dynamic seminar the Operating Procedures Group. There was turnover, of course, and the time-line has become jumbled in my mind – some people were earlier in, some earlier out, and not everybody I'll name were strict contemporaries. That said, Jack White, our chief ecologist, and Larry Master, who became our chief zoologist and took the lead on the Vertebrate databases (as Larry Morse did for the plants) were involved whenever they were in town. Sometimes they came just for this. Same with the other regional Heritage task force directors – Joe Jacob, Steve Chaplin, Scott Peterson, and later Ben Brown, and with the Regional information Managers – Margaret Ormes, Audrey Godell , Donna Snyder. Mary Jean Huston – who am I forgetting? Jan Cassin, Eugenie Drayton, Robin West… I think Mary Klein might have started out as a RIM, but I mainly remember her in later roles – hard worker, she.

Other sometime participants that spring to mind are Patrick Bourgeron, George Fenwick, Phil Hoose, Walt Matia, Rene Dagseth, Dave Wilcove, and later Denny Grossman. And our central data manager, Shara Howie. Any State Heritage staffers that visited HQ were apt to be dragged in and sometimes they came specifically with new suggestions – Tom Smith, Sue Crispin, Tom Breden, Jim Muller, and Tony Wilkinson leap to mind, but it would be unfair of me to try to make a full list. If you were around then, you were involved. Each of you can probably remember things you contributed that I thought I did. We frequently included people from other departments, especially Stewardship after I'd had spun it off -- Steve Buttrick was much involved and Bob Unnasch took the lead on the Stewardship formats and contents. I can remember Will Murray, Chuck Bassett, Tim Barnett, and Brad Northrup at various times. Ray Culter and especially John Humke were in and out over the years, wearing many hats. Members of our Latin American Heritage group came in later, especially Richard Warner, but also Shirley Keel and Luis Corrales. Oh yes, Ann Lewis, who had lead responsibility on the Heritage Operations Manual, was often there to contribute and keep notes. I had a whole string of secretaries, all too good for me, ending with Ursula McGhee, and the spill out of this activity often fell on them.

We periodically shanghaied people from outside that we thought might have something to add. We also brought in as many of our outside competitors as we could, to hear what they were doing, to borrow anything worthwhile, and as a route to possible joint venturing or converting

them to the fold. There were a lot of such people and institutions, mostly just stones in our road, and representing enormous wasted resources – another long and instructive story untold.

Of all the outsiders we involved in our design discussions the one who made the most signal contribution was Kerry Walter, of BGBase fame. Just as we reached the limits of what we could do in relational databases – the intersection files were overwhelming us – Kerry introducing us to Revelation software. GIS could probably have saved us then, but it was glitchy and unaffordable at the time. Advanced Revelation got us out of the bottleneck and made the 6th generation, the BCD, possible. Kerry should have been mentioned when the BCD won a Smithsonian-Computerworld award.

Over the years these meetings dealt not just with systems and methodology but with administrative, political, and funding matters. There were no boundaries except to focus on whatever needed to be done next. One long episode I remember vividly was when John Humke, Hardy, Phil Hoose, Greg Low and I put our heads together over the project-protection side of things and jointly came up with the Natural Diversity Scorecard -- at about the same time as Chip and I were writing the Preserve Selection and Design Manual. This was the high water mark in systematic biodiversity conservation planning, at least as an integrated part of the Conservancy-Heritage nexus.

At a later point, as the main methodological variables began to settle into place, what had been a genuine moveable feast became more formalized. The membership of an official OPG solidified somewhat, including specific people from various Heritage programs – there may even have been elections, I can't remember – and the group mainly functioned to provide a broad review of what was workable and what else was needed. We hired Steve Taswell to do the thankless job of coordinating its activities, tracking system evolution, and listing proposals for new experimentation. But outside of this, the whiteboard meetings went on to the end.

To anyone who I've forgotten to mention in the above account, I apologize. Please blame it on the gathering cobwebs. The sting will be gone when this speech is consigned to the bottom of the bird cage.

Operating reserve

In those halcyon days one important factor was that we had managed to accumulate a considerable operating reserve (I could tell someone how we did it) – not quite the year's cash operating budget that Bill Gates has always kept on hand, but upwards of a third of that. Hardy and I called the reserve our "wasting endowment" because we dipped into it whenever something sufficiently important needed to be done. This gave us considerable flexibility to quickly pursue good ideas when they popped up. In fact, this reserve was just part of a whole different management philosophy we employed. We didn't,

for example, pre-assign unitary budgets for this group or that to spend as they liked. Instead we funded tasks and our reserves allowed us to allocate money strictly on a need basis. Nobody stalled out because they'd run through their budget while money was wasted on trivialities somewhere else. Unlike many so-called managers, we knew every part of our business intimately and so were equipped to operate like this.

For that matter, we knew everything about the entire Conservancy – I used to say, "If you want to know TNC, learn BCD" -- and we sometimes shared our reserve out a bit among other Conservancy departments – the rest all operated with traditional budget practices and had no reserves – when something came up that we thought significant. For instance, when Brad Northrup's administration department decided to bring the membership data in-house from an outside service bureau, we bought a second HP mini-computer for them and trained Lyndon Woodall, Peter Whitford, and others until they were up and operating. Databases for donor information and other support functions were added and we even helped design several of them. Another digression – I've never been able to comprehend why governments always return excess revenues as tax returns or why most organizations spend every penny on current operations – couldn't they hold back some of it? Can't they grasp the immense importance of maintaining a flexible resource pool? But then their managers generally don't know anything.

Here I want to step back a bit and acknowledge two quite important things that didn't begin with me and to cite the people with whom they did.

It may surprise you to know that it wasn't I that originated the idea of the Element Occurrence. The inspiration for this came from Dale Jenkins (not related, by the way), an entomologist and the Chief Ecologist for the Smithsonian. We became friends just after I started at the Conservancy, when we both served on two overlapping committees -- the IBP inventory committee and a separate Federal Committee on Research Natural Areas. Dale and I had convergent interests and within a couple years had co-founded a joint venture called the Smithsonian Center for Natural Areas (another untold story ending in intrigue and perfidy) and built up a small staff, mostly doing contract inventories for the Park Service's National Natural Landmarks program. From somewhere we got a grant to do an inventory of the area surrounding the Chesapeake Bay. We had basically been using the same old IBP checksheet approach but in this case Dale thought it was a good idea to throw in known localities for some rare species, which we began gleaning from the Smithsonian's specimen collections. You might have thought that I'd have had my eureka moment right then and there but no, it took another several years before things suddenly gelled for me. When they did this memory from the Chesapeake inventory immediately clicked into place.

A second thing I didn't think of first was Element ranking. After my eureka moment I was too busy to engage in inventory myself. Those so engaged were encountering difficulties I hadn't foreseen. One of these was the practical question of how to ascertain which elements were

rare and needing attention. We all knew that official lists of protected and endangered species were undocumented nonsense but my simple-minded idea was that after creating our preliminary element lists we would hustle out and gather occurrence information – and then the accumulating occurrence data would begin to tell us what was rare. I just never ran the numbers. Fortunately, not too long into the new process I visited the even newer Minnesota program to review progress. I met individually with each member of the staff and when I got to Welby Smith, the botanist, he told me, maybe a little reluctantly because everyone knew how strongly I felt about standardization, that his first step after compiling a complete list of vascular plants was to "stratify" it. He was already an expert on Minnesota's flora and knew more than enough to begin segregating it into those taxa that were demonstrably abundant, those that were common, those that he and others believed to be rare, and those about which he didn't know enough to make a preliminary judgment. Then he began gathering information, including occurrence information, on those in the latter categories. As soon as he told me this I said, "Of course," probably clapping my hand to my head, and went home to begin work on a formalized rarity and endangerment assessment and documentation process. My first cut at Element Ranking wasn't much different from Welby's, but as with everything else, this went through many iterative and tortuous stages before it settled into relatively stable form. Hardy recently reminded me of some of the significant steps, like the split into G, S, and N ranks, but no time for that here. What a difference those ranks made. How different a project package was with not just names of things, but with ranks attached.

As for me, methodology and system design weren't my only jobs in the Conservancy. I was also the chief fund-raiser for Science and Heritage. We received very little of our support from the Conservancy general fund -- about 95 percent of what we did at headquarters and in our regional offices was self-funded, as was all of the vastly greater funding for the state Heritage programs. I was initially the salesman for new programs also, but John Nutter soon took the lead on this, and when he changed jobs, Hardy took over. Frank Boren called him our "traveling salesman." A few words on selling the programs -- early on we set up a priority list of states, ranked mostly by the likelihood that they would buy the idea. We were completely wrong. It turned out to be easier to penetrate a vacuum than to get into a state with an established natural area program and vested interests. Some people wanted to produce a brochure but I never would, because I knew we needed to "bait the hook to suit the fish." For example, a key contact in one state would be hell-bent for land use planning, his or her counterpart in the next would absolutely hate it, and by not pre-committing we could honestly say that our same unvarying program could be looked at either way -- as land use planning or as an alternative to it. These days I'd have a brochure in digital form and would tailor it to state prejudices. Anyway, selling the States was often very hard but Hardy persisted. He had it boiled down to a 5 stage process – you'll have to ask him about that -- and getting all 50 states was his triumph.

But to continue -- I was also the main liaison between the department and the Conservancy at large, where I was still the main theoretician and spiritual guide, and a key fund-raiser as well -- drafting a number of their largest proposals and, as far as I can remember, conceiving every one of their national campaigns. I was also the department's emissary to the outside world – giving speeches, writing papers and such. And it fell to me to be the chief politician – the internal and external politics were always fierce and I fought more battles than Napoleon, winning all the crucial ones but the last.

Frankly, taken all together, the job was an awful grind. I didn't eat breakfast or lunch; slept about 4 or 5 hours a night – ask my wife -- waking up frequently to write notes; worked 60 hours a week, often 70 or 80; took 2 sick days in 23 years and gave up almost a year of unused vacation time when I finally quit. I'm not naturally energetic – ask anyone – but the pressure to move forward was always great and it was generally easier for me to do it than to try to explain to someone how to do it or to make what they did mesh with the rest. Here's a typical story - at the end of a CDC conference in Paraguay, when everybody else took a several day trip to Iguazu Falls, I was back in Assuncion trying to work through one more damned methodological problem. Other Conservancy people traveled a lot to scope out the landscape and seemed to enjoy it but I never had time to. I traveled to unavoidable meetings, Heritage and Conservancy offices, or to potential funding sources. My life was spent in my office. The only thing that saved me was that I did as little as possible on the administrative side – Hardy Wieting, Bob Chipley, John Nutter and then Loring Schwarz, Shelley Rodman, and others took care of nearly all of that. It's lucky my Spanish was so bad or I would have been translating everything into Espanol.

About the only person outside the department who ever fathomed my work load was Beryl Collins, for several years the chair-person of the Board's Science Committee and an early computer guru herself. She was aghast to discover that I was still functioning as chief technician and urged me to give it up. Was this any way for the head of such an enterprise to behave? Delegate, delegate! I really wanted to – maybe I could get a life and the rest of my jobs could always benefit from more attention. So I tried three times to replace myself as chief designer, but it never worked out. One of the candidates was notably smarter than me, I thought, and I had high hopes – he was an able mathematician, had a strong computer background, a quick grasp of many things I could scarcely fathom, and lacked my attention deficit disorder– yes, I've suffered from this all my life and I don't understand how this goes with my eyes glazing over last. Anyway, this guy was terrific, but he lacked my long experience and motivation and when he began to understand what a boggling thing it all was he bolted for a musical career. Back to the grind for me.

If there were time, I was going to tell the story here of the most grueling episode of my system design career – developing the modules for the Conservancy's project business. It was one of the most complex things ever and I did it almost entirely alone, working straight through one night a week for what turned out to be a year and a half. I don't know if any of you have ever even seen that part of the data structure but it was the last major part of the BCD and is still used to manage Conservancy project data, driven by later generations of software, the same way the rest of the data model still underlies your own work. As far as I know it's still the best anyone has ever done in systematizing the complexities of real estate.

I think I need to wind this up by recounting how I finally happened to let it all go – or rather, how it was finally wrested from my hands. As I mentioned earlier, the Science and Heritage programs within TNC were almost completely self-funded. Otherwise they wouldn't have existed at all, because internal competition for dollars was strong. The last year I was in charge, 1993, our core science operating budget was about $15 million, with the combined budgets of all of the Heritage programs -- not directly within our control, to be sure, but still part of an integrated operation -- many times greater. Our operating reserve stood at nearly $5 million. If we had been a stand-alone organization our core budget and staff numbers would have put us among the 10 largest conservation organizations in the world. If we counted the budget and staff of the entire network the combined enterprise would have placed second only to TNC itself, or perhaps it was even bigger -- I've never really made a detailed comparison. Our clear path required us to keep growing if we were to continue to lead the way, keep up with changing technology, and complete our drive to blanket the Earth. But with relative suddenness, we hit the wall. The reason was that the Conservancy, and especially the state field offices, had grown up around us, and now someone else had first call on every private funding source. Over the years we had cracked more than 100 foundations and corporations for first grants to the Conservancy, and often the biggest ever, and now we had access to not a single one of them. The problem goes back to the behavior of the funders. Nearly all the foundations, corporations, and individuals are check-listers. If they give a grant to the California field office, they check off their TNC box for that funding cycle – with no opportunity for another branch of the organization to even get a hearing. We could have fought it out within TNC for access – that's how these things were usually resolved -- but the best we could hope for was only a fraction of what we needed. Besides, we cared about the other Conservancy functions and displacing a proposal from a field office in favor of one of ours didn't seem like a winning proposition – or one that would maintain harmony within the organization. There were already tensions enough. On more than one occasion, for instance, I was able to fight off strong attempts to make State Heritage staffs report directly to the Conservancy field offices. I generally deflected this with the argument that it was more logical for them to report to you.

I concluded that the only rational solution to our funding impasse was for science to spin off as its own organization, with its own box on the funder's check-lists. I wrote a white paper arguing the case, proposing a division-of-labor model for a sort of super-organization in which the Science-Heritage spin-off would continue to develop and support information systems for TNC use, at no cost to them, and to redirect their science activity into ecological management. I thought it was a great plan and actually pushed it through to the final staff approval stage. In one meeting, John Sawhill told me to "Quit

arguing, Bob, you've got what you want." However, he forbade me to distribute the white paper to the board of governors or to argue the case to them. I was warned by one friendly board member in the know that a board would never let something so successful and ornamental out of their hands. Boards are short on deep institutional theory or knowledge, as are generalist presidents, and in the end, sure enough, they wouldn't let us go. I blew up in the Science committee at my second last Board meeting and denounced the alternative plan at my last in take-no-prisoners terms, calling it a hopeless and incompetent plan generated by incompetent people, and resigned in disgust. I probably shouldn't have done either.

I retired to my tent, hoping that TNC would eventually come to its senses but no one in authority there ever did. Of course they did eventually spin you off – in what at least one board member publically-declared was a "Jenkins was right" move -- but when the moment came it was more to divest themselves of a burden and an insightful move, and they failed to create the division-of-labor model that I had proposed, or, of course, to include me. I repeatedly entreated subsequent Conservancy leaders to institute the model but they reneged on promises to do so. In failing to do this right TNC damaged itself, you, and the overall biodiversity conservation enterprise, but then my greatest shortfall was a failure to sufficiently transform the Conservancy culture. Pope's gone, let's party. They've gone off and made huge, duplicative, disparate, and inefficient system investments that contributed nothing to the main sequence and accomplished far too little even to meet their own perceived needs. Another subject I tire of.

As for me, as I left TNC I had a sort of exit interview with Sawhill. He said to me, "Bob, with your record you can write your own ticket" (that's how these careerists think and talk, especially guys who never spent more than 5 years in a job). "Any university or conservation organization will be eager to have you." "No, John," I replied, "I've made myself into a machine for doing exactly the thing that I do. I won't be good for anything else and there's nothing else that I want to do."

Anyway, in closing, I'd just like to say -- here I am looking soulfully at the plaque – of all the awards I've ever received, because of who's giving it, this most recent one means the most to me. After all this time, I still think of you all as my people. So thank you, thank you very much.